DICOM Conformance Statement Cios Family VA20, VA10

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SIEMENS Healthineers

1 Conformance Statement Overview

The Cios Family provides a Siemens Healthineers Imaging Modality based on **FLUOROSPOT® Compact**. This DICOM Conformance Statement is valid for the following products:

- Cios Alpha VA20
- Cios Fusion VA20
- Cios Connect VA20
- Cios Select VA10

The Cios Family is designed to be integrated into an environment of medical, DICOM-based devices.

The Cios Family conforms to the DICOM Standard and supports the network services as described in "Table 1: Network Services" and the media services as described in "Table 2 - Media Services".

Table 1: Network Services

SOP Classes	SOP Class UID	User of Service (SCU)		Provider of Service (SCP)	
Verification					
Verification	1.2.840.10008.1.1	Yes		Yes	
SOP Classes created by Cios Family					
		Create	**Send**	**Store**	**Display**
Secondary Capture Image Storage (as Exam Protocol)	1.2.840.10008.5.1.4.1.1.7	Yes	Yes	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes (see Note 1)	Yes	Yes	Yes
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes	No	No
SOP Classes managed by Cios Family					
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	No	Yes	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	No	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	No	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	No	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	No	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	No	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	No	Yes	Yes
Storage Commitment					
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Yes		No	
Worklist Management					
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes		No	

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SOP Classes	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes	No
Query/Retrieve			
Study Root Q/R - Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Q/R - Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Print Management			
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Yes	No
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Yes (for Grayscale)	No

Note 1: Not Created, but captured by the videomanager and included in the patient's study

Table 2 - Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk - Recordable		
General purpose CD-R interchange	Yes (see Note 1)	Yes
DVD		
General purpose DVD interchange with JPEG	Yes (see Note 1)	Yes
USB		
General purpose USB Media interchange with JPEG	Yes (see Note 1)	Yes

Note 1: with uncompressed setting

Table 3 - Implementation Identifying Information

Name	Value
Application Context Name	1.2.840.100008.3.1.1.1
Implementation Class UID	1.3.12.2.1107.5.3.4
Implementation Version Name	"SIEMENS_FLC_70"

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3 Introduction

3.1 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.2 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Cios Family and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability.

The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of conformance statements is the first step towards assessing interconnectivity and interoperability between Cios Family and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

Siemens Healthineers reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens Healthineers representative for the most recent product information.

3.3 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Additional Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ASCII	American Standard Code for Information Interchange
DCS	DICOM Conformance Statement
DICOM	Digital Imaging and Communications in Medicine
FSC	File Set Creator
FSR	File Set Reader
FSU	File Set Updater
GSDF	Grayscale Standard Display Function
IOD	DICOM Information Object Definition
ISO	International Standard Organization
n. a.	not applicable
NEMA	National Electrical Manufacturers Association
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
R	Required Key Attribute

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SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM Server)
SOP	DICOM Service-Object Pair
SR	Structured Report
TFT	Thin Film Transistor (Display)
TID	Template ID
U	Unique Key Attribute
UID	Unique Identifier
UTF-8	Unicode Transformation Format-8
VR	Value Representation

3.4 References

NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at http://medical.nema.org/)[1]

Integrating the Healthcare Enterprise – IHE Radiology Technical Framework – http://www.ihe.net

[1] *The DICOM Standard is under continuous maintenance, the current official version is available at http://dicom.nema.org*

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4 Networking

4.1 Implementation Model

Cios Family supports storing DICOM images to remote nodes like workstations or Archiving Systems. Using the Storage Commitment Service it can request safe keeping of previously stored instances from an Archiving system. Additionally, the Cios Family can query remote notes, retrieve and store selected instances from that node. Using the Modality Worklist Service the Cios Family can query a HIS/RIS for scheduled procedures. Performed procedure status and other procedure data can be returned to the HIS/RIS using the Modality Performed Procedure Step (MPPS) Service. Furthermore, printing of grayscale images is supported.

4.1.1 Application Data Flow

The following figures provide a functional overview of the Cios Family Application Entities (AE). Relationships are shown between user-invoked activities (in the circles at the left of the AEs) and the associated real-world activities provided by DICOM service providers (in the circles at the right of the AEs).

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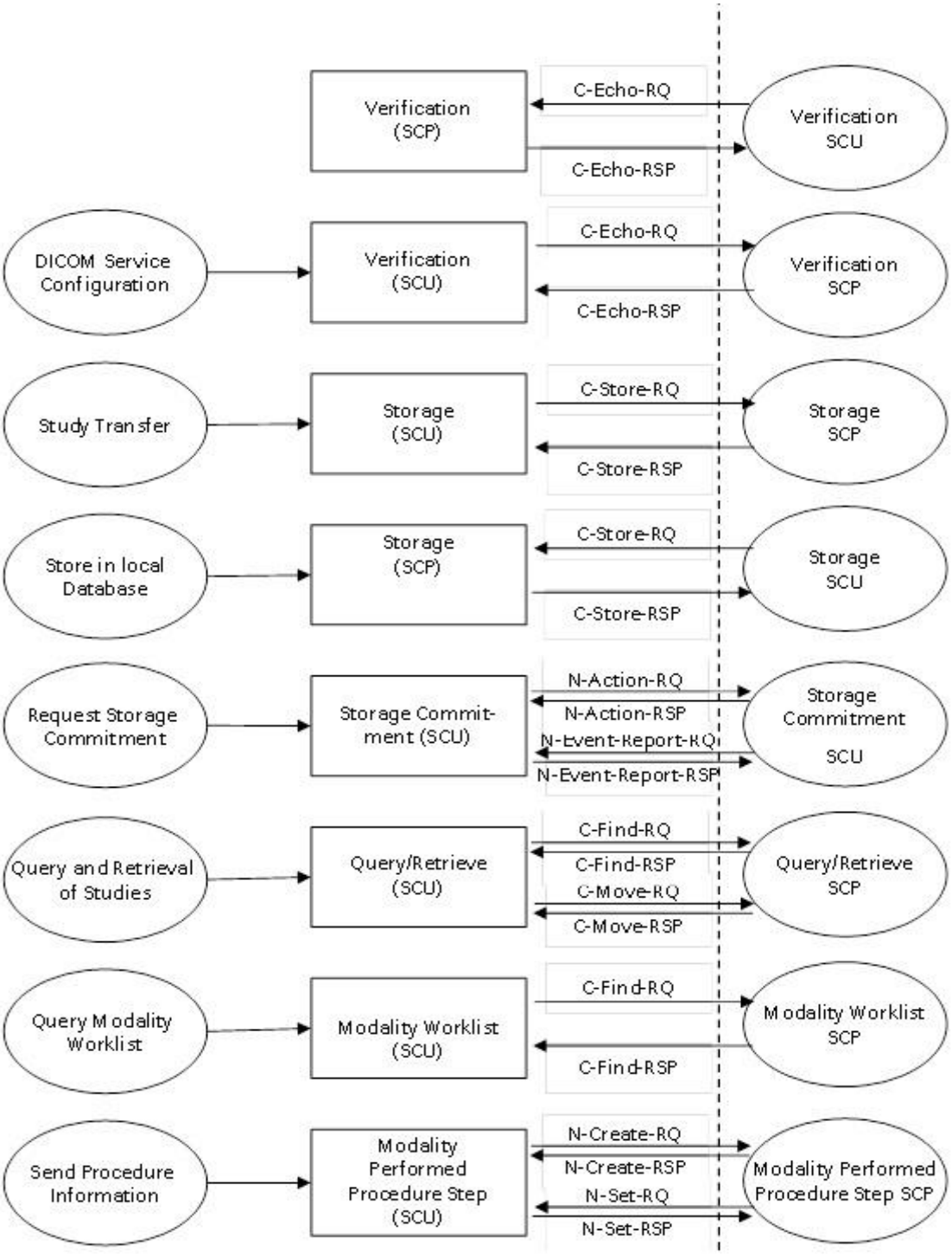

Figure 1: Cios Family DICOM Data Flow diagram – Acquisition Workflow

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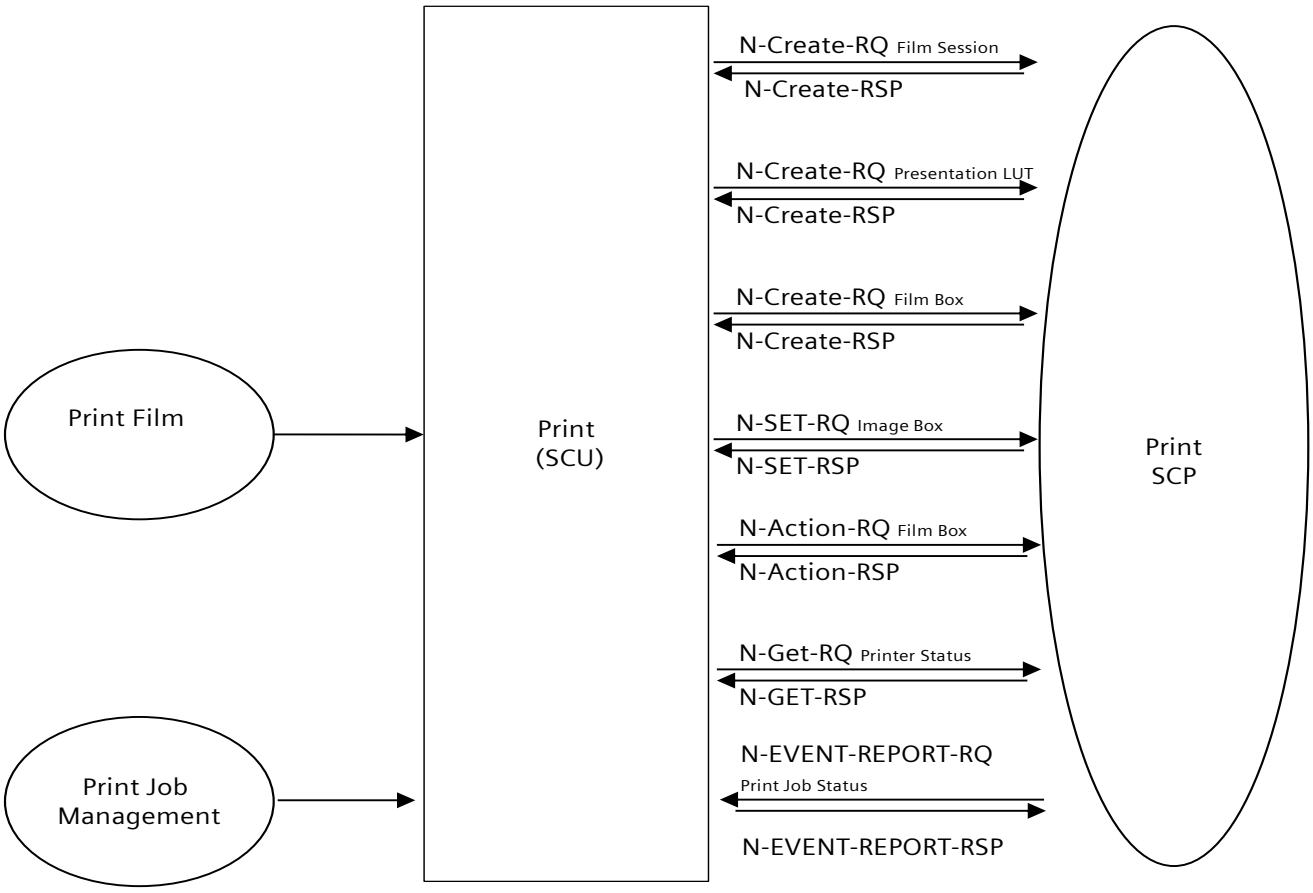

Figure 2: Cios Family DICOM Data Flow diagram - Printing

- The Cios Family DICOM Service Tool application opens an association when a "verification" of a remote application is requested during a configuration session. This can be done when entering new data to configure a remote application or to verify existing configuration data.

- The Storage SCU AE can send Composite SOP Instances and automatically request Storage Commitment for sent SOP Instances, if configured and handles incoming commitment status N-EVENT messages.

- The Storage SCP AE can receive incoming DICOM images and add them to the local database. It can respond to external Storage and Verification Requests as a Service Class Provider (SCP) for C-ECHO and C-STORE requests. Last mentioned requests are only handled in combination with Query/Retrieve.
  The Storage SCP AE supports Composite SOP Instances as indicated in chapter 1 “Conformance Statement Overview”.

- The Query part of the Query/Retrieve SCU AE uses C-FIND to search a DICOM Database for Patient Study and Series information.
  The Retrieve part of the Query/Retrieve SCU AE uses C-MOVE to initiate a DICOM transfer of composite objects to the local database.

- The Print SCU sends film-sheets with n images to the printer. The printer status is monitored by sending Status requests.

- The Worklist SCU AE runs autonomously for cyclic "broad" query and issues C-FIND Worklist model requests. It can be manually triggered for most recent data. A "broad" query with user input can be triggered separately.

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- The MPPS AE uses N-CREATE when first radiation exposure is released for a patient and updates via N-SET when closing the examination (triggers "final N-SET").

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4.1.2 Functional Definitions of Application Entities

The SCP components of the Application Entities of the Cios Family operate as background server processes. They exist as soon as the system is powered up and wait for association requests. Upon accepting an association with a negotiated Presentation Context they start to receive and process the requests described in the following sections.

4.1.2.1 Functional Definition of Verification AE

4.1.2.1.1 Functional Definition of Verification SCU AE

The Cios Family DICOM Service Tool application opens an association when a "verification" of a remote application is requested during a configuration session. This can be done when entering new data for remote application configuration or to verify existing configuration data.

4.1.2.2 Functional Definition of Storage AE

4.1.2.2.1 Functional Definition of Storage SCU AE

The Cios Family Storage SCU is invoked by the job control interface that is responsible for processing network archival tasks. The job consists of data describing the composite image objects selected for storage and the destination. An association is negotiated with the destination application entity and the image data is transferred using the C-STORE DIMSE-Service. Status of the transfer is reported to the job control interface.

With each successfully completed send job, the Cios Family DICOM Application will populate the Storage Commitment Push Model Action Information from the SOP Instances sent. Then a Storage Commit Request is triggered, if configured. Depending on configuration, the Cios Family DICOM application will keep the association open for responses with a configurable time-out, or closes the association and expects responses on a different association that has to be established by the remote Storage Commitment SCP.

The commitment status derived from the related trigger response will be indicated in the related Status Flags of the related entity. It is possible to create triggers ("auto rules") from this event.

The Transaction UIDs of the pending commitment request are kept "open" (Job-status is "waiting") for a configurable time (default: 1h). If the "open time" for a pending commitment request has elapsed w/o a related response from the provider, the Transaction UID is removed and the related entities are indicated as "commit failed".

Open Transaction UIDs of pending commitment requests are discarded after a reboot of the system. The related entities are indicated as "commit failed".

4.1.2.2.2 Functional Definition of Storage SCP AE

The Storage SCP component of the Cios Family DICOM application is operating as background server process. The process starts when the system is triggered to import images and waits then for Storage association requests. Upon accepting an association with a negotiated Presentation Context it starts to receive the Composite Image Objects and imports them to local database.

The Verification SCP is included in the Storage SCP.

4.1.2.3 Functional Definition of the Storage Commitment AE

4.1.2.3.1 Functional Definition of Storage Commitment SCU AE

The Storage SCU AE can send Composite SOP Instances and automatically request Storage Commitment for sent SOP Instances, if configured and handles incoming commitment status N-EVENT messages.

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4.1.2.4 Functional Definition of Query/Retrieve AE

4.1.2.4.1 Functional Definition of Query/Retrieve SCU AE

The Cios Family DICOM Query/Retrieve SCU requests the remote Query/Retrieve SCP to perform a search and match to the keys specified in the request in order to display the results in the system's user interface. Depending on user action (Import) the Cios Family Query/Retrieve DICOM SCU sends a C-MOVE DIMSE service to initiate a C-STORE sub-operation on the SCP to start an image transfer from remote Storage SCU (running on Query/Retrieve SCP) to the system's Storage SCP.

4.1.2.5 Functional Definition of Modality Worklist AE

4.1.2.5.1 Functional Definition of Modality Worklist SCU AE

The worklist SCU ("broad query") is invoked from the patient mode or by timer to request the worklist from a remote Information System (Modality Worklist Class SCP). The worklist SCP responses to the C-FIND query and scheduled imaging service requests (scheduled procedure steps) and patient demographic information will be "pulled" from the information system to the Cios Family modality. All information retrieved will be held in the scheduling database for usage during Patient Registration procedure.

Furthermore, the patient based Query dialog from the patient mode allows entering specific matching criteria ("narrow query") for the worklist query. With the response data the Patient Registration dialog can be populated according availability within the worklist response identifier.

4.1.2.6 Functional Definition of Modality Performed Procedure Step AE

4.1.2.6.1 Functional Definition of Modality Performed Procedure Step SCU AE

With first radiation exposure for a registered Patient (i.e. a Scheduled Procedure Step from Worklist), the Cios Family DICOM application will create an MPPS Instance and communicate it to the MPPS Manager (SCP). The status of MPPS is set to "Completed" when the patient is closed.

For unscheduled patients no MPPS message is sent.

4.1.2.7 Functional Definition of Print AE

4.1.2.7.1 Functional Definition of Print SCU AE

The Print SCU is invoked by the user interface to setup film-sheet layout and whenever an image is ready to be printed on film. The Print SCU will hold and maintain all data needed to compile a complete film-sheet from the data (images, layout, configuration) received. Whenever a film-sheet is ready to print the related data is used to supply the Information to the SOP Classes of the Print Management Service Class. A queue is maintained, in order to intermediately store several film-sheets in case of resource problems on printer. The SCU will only supply and require the mandatory SOP Classes of the Print Management Service Class.

4.1.3 Sequencing of Activities

4.1.3.1 Verification

Newly entered data have to be saved first, before a "verification" of these data is possible.

4.1.3.2 Storage

Prior to sending of SOP Instances the Cios Family Storage application is capable of invoking processing and resizing features in order to prepare image pixel contents into convenient formats for certain multi-vendor environments.

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The Storage Commitment trigger is automatically derived from the successful completion of a Send Job.

4.1.3.3 Query/Retrieve

Retrieve of images is only possible if a result from a previous "Search..." operation exists and those entities can be selected for "Import".

The Query application will not "per se" request information on SERIES level. The user can select a study and request series level information with the "Series List" function.

4.1.3.4 Workflow

The "narrow" (interactive) Worklist Query requires that sufficient matching keys or a unique matching key are/is entered before the query is issued. Only then a single response can be expected to complete the registration dialog.

An MPPS N-CREATE message is sent when radiation is exposed for a patient. For procedure steps registered as "emergency" cases no MPPS N-CREATE is sent.

4.2 Application Entity Specification

This section outlines the specifications for each of the Application Entities that are part of the Cios Family.

4.2.1 Verification AE Specification

4.2.1.1 SOP Classes

The Verification AE of the Cios Family provides standard conformance to the Verification SOP Class listed in "Table 1: Network Services" section "Verification" in chapter 1 “Conformance Statement Overview".

4.2.1.2 Association Policy

4.2.1.2.1 General

The Cios Family DICOM Service Tool application attempts to open an association for verification request whenever the "C-Echo" Button is activated in network diagnostics for configured AETs.

4.2.1.2.2 Number of Associations

The Cios Family DICOM Service Tool application initiates one association at a time to request verification.

4.2.1.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.1.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 “Conformance Statement Overview".

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4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – "Send Verification" Request

4.2.1.3.1.1 Description and Sequencing of Activity

The Verification SCU C-ECHO request is initiated by Service and Diagnostic SW whenever "Verification" is requested. If an association to a remote Application Entity is successfully established, Verification with the configured AET is requested via the open association. If the C-ECHO Response from the remote Application contains a status other than "Success" this will be indicated in the service environment and the association is closed.

4.2.1.3.1.2 Proposed Presentation Contexts

Table 4: Presentation Context Table "Send Verification" below lists the supported presentation contexts for verification requests.

Table 4: Presentation Context Table "Send Verification"

Presentation Context Table - "Send Verification"					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	none

4.2.1.3.1.3 SOP Specific Conformance – Verification SCU

The ECHO-SCU provides standard conformance to the Verification Service Class.

4.2.1.4 Association Acceptance Policy

The Verification SCP is part of the Storage SCP.

4.2.2 Storage SCU AE Specification

4.2.2.1 SOP Classes

The Storage AE provides Standard Conformance to the SOP Classes listed in "Table 1: Network Services" section "SOP Classes Created by the Cios Family" and "SOP Classes Managed by the Cios Family" in chapter 1 "Conformance Statement Overview".

4.2.2.2 Association Policy

4.2.2.2.1 General

The DICOM Storage application will be triggered by the transfer job queue. An association request is sent to the destination AE and, upon successful negotiation of a Presentation Context, the transfer is started. Depending on configuration, processing or resizing can be applied to the images prior to being sent.

With a Send Job successfully completed, the DICOM application will generate the Storage Commitment Action Information (if configured) which references to all Instances of the processed job. The Commit Request is sent over a single opened association. The Cios Family will wait for Status responses of the Storage Commitment Request. If the Provider

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accepts the Storage Commitment with Success Status, the generated Transaction UID, together with study identification data and a time-stamp, is kept. Depending on configuration, the association is closed or kept open for a configured time range. If the association is closed immediately, the response is expected on a different association which is the default setting. Multiple Storage Commitment Requests can be pending. "Text"

The default PDU size used will be 64KB.

4.2.2.2.2 Number of Associations

The Cios Family DICOM application initiates one association at a time.

4.2.2.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.2.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 “Conformance Statement Overview".

4.2.2.3 Association Initiation Policy

If a job with network destination gets active in the job list or a retrieve sub-operation is processed, the Cios Family DICOM application attempts to initiate a new association for

- DIMSE C-STORE to send images and with successful status and
- N-ACTION DIMSE for the Storage Commitment Push Model Service Class to request commitment.

4.2.2.3.1 Activity – "Send to..."

4.2.2.3.1.1 Description and Sequencing of Activities

The C-STORE request is triggered by an export job with network destination. If the process successfully establishes an association to a remote Application Entity, it will transfer each image one after another via the open association. Processing features and resizing of the pixel matrix can be applied as part of the transfer. If the C-STORE Response from the remote Application contains a status other than "Success" or "Warning", the association is aborted.

With success status for the previous transfer, the Cios Family Storage application sends, if storage Commitment is configured, the commit request (N-ACTION-RQ) message and waits for acceptance of this request (N-ACTION-RSP). After receiving this, the transaction is marked as "waiting".

The association will be closed after a maximum of 10 seconds. After that receiving the storage commitment status is expected on a different association. If the commit response (N-EVENT-REPORT) does not arrive within the configured time-out, the transaction will be marked as failed.

4.2.2.3.1.2 Proposed Presentation Contexts

For all Image Objects listed in "Table 1: Network Services" in in chapter 1 “Conformance Statement Overview" the Transfer Syntaxes marked with "yes" in the Image Objects Column of the table below are supported.

For all Non-Image Objects listed in "Table 1: Network Services" in chapter 1 “Conformance Statement Overview" the Transfer Syntaxes marked with "yes" in the Non-Image Objects Column of the table below are supported.

For a distinction between Image and Non-Image Objects please refer to the DICOM Standard PS3.3 Section A.1.4 "Overview of the Composite IOD Module Content".

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Table 5: Proposed Presentation Contexts for Storage

UID value	Transfer Syntax	Image Objects	Non-Image Objects	Storage Commitment SOP Class	Role	Ext. Neg.
1.2.840.10008.1.2	Implicit VR Little Endian	yes	yes	yes	SCU	none
1.2.840.10008.1.2.1	Explicit VR Little Endian	yes	yes	yes	SCU	none
1.2.840.10008.1.2.2	Explicit VR Big Endian	yes	yes	yes	SCU	none

4.2.2.3.1.3 SOP specific Conformance – "Send to..."

The Cios Family can send images in different formats. In a user and destination specific service level configuration it can be configured whether images are sent original or resized.

For association and DIMSE level time-outs, please refer to section Configuration (4.4.2 **Parameters**) of this document.

Please refer to the related Image Object definition tables in the section Annexes (9.1.1 Created SOP Instances) for a list of all DICOM IOD attributes of type 2 and 3, which are encoded by the Cios Family applications.

The DICOM images sent by Cios Family DICOM application conform to the DICOM IOD definitions (Standard extended IODs). But they will contain additional private elements, which have to be discarded by a DICOM system when modifying the image.

The DICOM nodes are responsible for data consistency when modifying images. All unknown private attributes have to be removed upon modification!

Please refer to section Annexes (9.5 Standard Extended / Specialized / Private SOP Classes) for a list of possible private IOD attributes.

4.2.2.3.1.4 SOP specific Conformance – "Request Commitment"

Storage Commitment is supported for all the SOP Classes detailed in "Table 1: Network Services" in chapter 1 "Conformance Statement Overview".

The Referenced Study Component Sequence is not supported.

Storage Media File-Set ID and UID Attributes will not be supported in the commitment request (N-ACTION primitive) invoked by the Storage Commitment SCU.

4.2.2.4 Association Acceptance Policy

4.2.2.4.1 Activity – Update Flag Information

4.2.2.4.1.1 Description and Sequencing of Activities

After sending a Storage Commitment Request the Cios Family either waits on the same association or, being configured to receive response on a separate association, closes the association and waits for an association request from the Storage Commitment SCP that wants to send the results.

Any incoming Notification will be checked for validity, that is, if the related Transaction UID is still part of the Pending Request Queue.

If the Notification is valid the related Instances are marked with the reported status. The over-all Commit Status of the higher Information Entities in the Cios Family database is derived from propagation of the States of all sub-ordinate Image entities included in a study.

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The Status Flags directly affected by Storage Commitment results and indicated in the different entities of the Patient previous list can be one of

- The flag chars S/s show, that all/some images are sent to a DICOM workstation and also committed, in case the DICOM destination is working with Storage Commitment.
- The flag chars A/a show that all/some images are sent to a DICOM workstation tagged as "Archive" and also committed, in case the "Archive" is working with Storage Commitment.

4.2.2.4.1.2 SOP-specific Conformance Statement for Storage SOP classes

If the Commitment response (N-EVENT-REPORT) received has the status of "complete - failure exists", the transaction is marked as failed, else the transaction is marked as "completed". In both cases, a message is shown to the user.

The related status flags are set for the committed images in the local database.

The Cios Family DICOM application will not support the Storage Media File Set ID attributes.

4.2.3 Storage SCP AE Specification

4.2.3.1 SOP Classes

The Storage AE provides Standard Conformance to the SOP Classes listed in "Table 1: Network Services" section "SOP Classes Managed by the Cios Family" in chapter 1 "Conformance Statement Overview".

4.2.3.2 Association Policy

4.2.3.2.1 General

The Cios Family DICOM application will accept any number of verification or storage SOP classes that are referred to above. There is no limit on the number of presentation contexts accepted except for the DICOM limit. In the event that the Siemens Healthineers DICOM application runs out of resources, it will reject the association request.

Cios Family will only accept Associations from known hosts with a known AET. Hosts and AETs have to be entered in "Local Service" by a Siemens Healthineers CSE.

The default PDU size used will be 64 KB.

4.2.3.2.2 Number of Associations

The Cios Family DICOM application accepts one association at a time.

4.2.3.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.3.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 "Conformance Statement Overview".

4.2.3.3 Association Acceptance Policy

The Cios Family DICOM application attempts to accept a new association for DIMSE C-STORE to send images and with successful status and

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- DIMSE C-ECHO for incoming Verification requests
- DIMSE C-STORE for external image senders request storage of instances
- DIMSE N-EVENT-REPORT for receiving commitment result from a previous request

4.2.3.3.1 Activity – Save to local disk

4.2.3.3.1.1 Description and Sequencing of Activities

The Cios Family DICOM application will accept an association and will receive SOP Instances according to the listed presentation contexts on that association and will store the images to the local hard disk if the conformance check is performed successfully.

Receiving is possible whenever an import request (C-MOVE) is sent to a remote destination. As long as it is active, the receiver process will accept an association and will receive images transmitted on that association and will store the images on disk in the own data base if the conformance check is performed successfully.

Upon successful receiving a C-STORE-RQ, the Cios Family DICOM receiver performs a plausibility test on the received image and available system resources. If this test succeeds, it returns the Status SUCCESS, otherwise one of the following status codes is returned and the association is aborted:

Table 6: Status Codes "Save to local disk"

Service Status	Meaning	Error Codes (0000,0900)
Failure	Refused: This error indicates a lack of Resources (e.g. not enough disk space) on the Cios Family modality.	A700
	Invalid Dataset: An error occurred while processing the image, which makes it impossible to proceed. The image will not be stored and the association is aborted.	A900 C000
Success	Successful	000

4.2.3.3.1.2 Accepted Presentation Contexts

For all Image Objects listed in "Table 1: Network Services" in chapter 1 "Conformance Statement Overview" the Transfer Syntaxes marked with "yes" in the Image Objects Column of the table below are supported.

For all Non-Image Objects listed in "Table 1: Network Services" in chapter 1 "Conformance Statement Overview" the Transfer Syntaxes marked with "yes" in the Non-Image Objects Column of the table below are supported.

For a distinction between Image and Non-Image Objects please refer to the DICOM Standard PS3.3 Section A.1.4 "Overview of the Composite IOD Module Content".

Table 7: Accepted Presentation Contexts for "Save to local disk"

UID value	Transfer Syntax	Image Objects	Non-Image Objects	Role	Ext. Neg.
1.2.840.10008.1.2	Implicit VR Little Endian	yes	yes	SCP	none
1.2.840.10008.1.2.1	Explicit VR Little Endian	yes	yes	SCP	none
1.2.840.10008.1.2.2	Explicit VR Big Endian	yes	yes	SCP	none

4.2.3.3.1.3 SOP Specific Conformance

The Cios Family application conforms to the Full Storage Service Class at Level 1.

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Any Explicit VR Transfer Syntax is preferred to be used by the Storage SCU when sending Composite Image Instances to the Cios Family DICOM application.

The following sections will differentiate the attribute contents required for Image Viewing.

Image Pixel Attribute Acceptance Criterion for Grayscale Images

The Cios Family Viewing application accepts pixel data with unsigned integer and 8 or 16 bits allocated.
Accepted values:

Pixel Plane

- Samples per Pixel (0028,0002) = 1
- Photometric Interpretation (0028,0004) = "MONOCHROME2" + "RGB"
- Only Pixel Aspect Ratio (0028.0034) 1:1 is supported
- Pixel Representation (attribute 0028,0103) = 0
- Bits Allocated (0028,0100) = 8, 16
- Bits Stored (0028,0101) = 8, 10, 12, 16
- High Bit (0028,0102) = 7, 9, 11, 15

Following restrictions are valid:

- For VOI LUT, only the linear LUT (Window Center/Width) and not the VOI LUT Sequence is supported.
- Display of overlay planes is not supported.
- No manipulations except windowing are allowed on imported images. Multiframe objects with identical image type are expected to be separated in series level.

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4.2.4 Query/Retrieve SCU AE Specification

4.2.4.1 SOP Classes

The Query/Retrieve AE provides Standard Conformance to the SOP Classes listed in "Table 1: Network Services" section "Query/Retrieve" in chapter 1 "Conformance Statement Overview".

4.2.4.2 Association Policy

4.2.4.2.1 General

With the "Query/Retrieve..." function the query data can be entered and the DICOM Query/Retrieve application is initiated. A query request will be sent out to one remote node that can be selected from a list of configured Query Providers. The results compiled from the response data will be displayed to the user. Upon request (Import), the retrieval of selected items is initiated.

The default PDU size used will be 64KB.

4.2.4.2.2 Number of Associations

The Cios Family DICOM application initiates one association for each query request.

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For Query it initiates a new association to the remote node and issues the C-FIND request to retrieve all the requested patient and study information matching the search criteria. For the Retrieve request (C-MOVE) only one association is initiated per destination.

4.2.4.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.4.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 "Conformance Statement Overview".

4.2.4.3 Association Initiation Policy

The Cios Family DICOM application will request associations for the following DIMSE-C operations as SCU:

- C-FIND
- C-MOVE

Extended negotiation (relational query) is not supported for the above listed services

4.2.4.3.1 Activity – Search for images (Search...)

4.2.4.3.1.1 Description and Sequencing of Activities

The associated activity is to fill out a query form with search data and pass it as query to the network application which issues a C-FIND over a previously built association. The remote SCP will respond with related data-entries that will be passed to a browser application. If needed, further associations are opened for querying data from sub-sequent entities. When data transfer is finished, each association is closed.

If the C-FIND Response from the remote Application contains an error status, the association is aborted.

4.2.4.3.1.2 Proposed Presentation Contexts

The Cios Family will propose Presentation Contexts as shown in the following table:

Table 8: Proposed Presentation Contexts for Query

Presentation Context Table - "Search"					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	none
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.4.3.1.3 SOP Specific Conformance

The Cios Family DICOM Query/Retrieve SCU supports hierarchical queries with all mandatory search keys. The interactive querying of attributes on IMAGE level is not supported by the Query SCU; hence retrieval of individual images is not possible. The following table describes the search keys for the different query models that the SCU supports. Matching is either wildcard, which means that the user can supply a string containing wildcards, or universal, which means that the attribute is requested as return value.

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Table 9: Attributes supported for instance Query – SCU (C-FIND Search Keys)

Attribute Name	Tag	Type	Matching	User input	Return Value Display
Patient Study Level					
Patient's Name	(0010,0010)	R	Wildcard2	enter value	yes
Patient ID	(0010,0020)	U / R	Wildcard	enter value	yes
Patient's Birth Date	(0010,0030)	O	Single value	enter value	yes
Patient's Sex	(0010,0040)	O	Single value	enter value	yes
Study Instance UID	(0020,000D)	U	Universal(Null)/ Single value	--	yes
Study ID	(0020,0010)	R	Wildcard	enter value	yes
Study Date	(0008,0020)	R	Universal(Null)	--	yes
Study Time	(0008,0030)	R	Universal(Null)	--	yes
Accession Number	(0008,0050)	R	Wildcard	enter value	yes
Study Description	(0008,1030)	O	Universal(Null)	--	yes
Number of Study related Series	(0020,1206)	O	Universal(Null)	--	yes
Number of Study related Instances	(0020,1208)	O	Universal(Null)	--	yes
Series Level					
Series Instance UID	(0020,000E)	U	Universal(Null)	--	yes
Series Number	(0020,0011)	R	Universal(Null)	--	yes
Modality	(0008,0060)	R	Universal(Null)	--	yes
Series Description	(0008,103E)	O	Universal(Null)	--	yes
Number of Series related Instances	(0020,1209)		Universal(Null)	--	yes

U = Unique Key, **R** = Required Key, **O** = Optional Key, **-** = not supported or applicable

The Cios Family Search application supports a

- DIMSE C-CANCEL

If the user wishes to cancel a running Query request via the Cios Family user interface ("Cancel" button while a "Search..." is active).

The Find SCU interprets the following status codes:

Table 10: Status Codes "Search"

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resoures	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	none
Success	Matching is complete - No final Identifier is supplied	0000	none

[2] Always a "*" is appended to the user-supplied string

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Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

4.2.4.3.2 Activity – Retrieve Studies (Import...)

4.2.4.3.2.1 Description and Sequencing of Activities

When selecting a data entry in the Query UI and activating the "Import" function, a retrieval request is passed to the Cios Family DICOM application which issues a C-MOVE service according to the Study Root query model. (The Storage Service Class Conformance Statement describes the C-STORE service, which is generated by processing the C-MOVE service.)

The received image data are processed as described in the Storage class SCP descriptions.

The Cios Family DICOM application will always insert the own Storage SCP AE as "Move Destination.

4.2.4.3.2.2 Proposed Presentation Contexts

The Cios Family Server DICOM application proposes Presentation Contexts shown in the following table:

Table 11: Proposed Presentation Contexts for Retrieve and Activity "MOVE SCU"

Presentation Context Table - "Import"					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	none
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.4.3.2.3 SOP Specific Conformance

All required keys will be provided in the retrieve request identifier, as defined in DICOM Standard.

The Move SCU interprets following status codes:

Table 12: Status Codes C-MOVE RSP ("Import")

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
	Unknown Destination	A801	n.a.
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901)

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			(0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

4.2.4.4 Association Acceptance Policy

n.a.

4.2.5 Modality Worklist SCU AE Specication

4.2.5.1 SOP Classes

The Modality Worklist AE provides Standard Conformance to the SOP Classes listed in "Table 1: Network Services" section "Worklist Management" in chapter 1 "Conformance Statement Overview".

4.2.5.2 Association Policy

4.2.5.2.1 General

It is possible to configure a cyclic update of the modality Worklist through a background worklist request with date/time and modality information.

In addition, the user can request worklist update with "Update Worklist". No duplicate entries will be added in the Worklist. Entries are uniquely identified by the Study Instance UID (0020,000D) for the Requested Procedure. An interactive worklist query can be issued with search criteria entered in the patient based Query dialog from the patient mode.

The default PDU size used will be 64KB.

4.2.5.2.2 Number of Associations

The Cios Family DICOM application initiates one association at a time to query worklist entry data.

4.2.5.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

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4.2.5.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 "Conformance Statement Overview".

4.2.5.3 Association Initiation Policy

The Cios Family DICOM application will cyclically query the worklist provider and by request from the patient registration interface. It establishes an association by using the

- C-FIND with Worklist information model

It is possible to configure multiple worklist providers but only one can be active at a time. The active worklist provider can be selected in the service.

4.2.5.3.1 Activity – (cyclic) Update Worklist

4.2.5.3.1.1 Description and Sequencing of Activities

A network application will perform worklist queries with the C-FIND request at regular intervals. In addition, it can be triggered by immediate request. All worklist data from previous queries will be deleted when new data is received.

No automatic clean-up of the Worklist is performed after a Patient-based Query since the worklist received - due to restricted search criteria - does not correspond to the list of all currently scheduled procedures for the modality.

4.2.5.3.1.2 Proposed Presentation Contexts

The Cios Family will propose Presentation Contexts as shown in the following table:

Table 13: Proposed Presentation Contexts "Update Worklist"

Presentation Context Table – "Update Flag Information"					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Worklist- FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	none
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.5.3.1.3 SOP Specific Conformance

Search Key Attributes of the Worklist C-FIND

The Cios Family DICOM worklist SCU supports "broad worklist queries" with all required search keys. The following table describes the "broad query" search keys that the SCU supports.

Table 14: Broad Worklist Query Search Keys

Attribute Name	Tag	Matching Key Type	Query Value
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Scheduled Station AE Title (It depends on service settings whether the "own AET" is provided or not.	(0040,0001)	R	<own AET> or <zero length>
>Schedule Procedure Step Start Date	(0040,0002)	R	<act. Date>-<act. Date> or range from UI

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Attribute Name	Tag	Matching Key Type	Query Value
(It depends on service settings whether the actual Date with a full time range or an interactive input dialog for date/time specification is used.)			
>Schedule Procedure Step Start Time (It depends on service settings whether the actual Date with a full time range or an interactive input dialog for date/time specification is used.)	(0040,0003)	R	00.00-235959.00 or range from UI
>Modality (It depends on service settings whether the "own Modality" is provided or not.	(0008,0060)	R	<zero length> or <own Modality>

R = Required

Return Key Attributes of the Modality Worklist C-FIND

The Cios Family DICOM Worklist SCU supports worklist queries with return key attributes of all types. The following table describes the return keys that the SCU supports.

Table 15: Modality Worklist C-Find Return keys

Attribute Name	Tag	M	R	Q	UI	IOD
SOP Common						
Specific Character Set	(0008,0005)		X			X
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)		X			
>Scheduled Station AE Title	(0040,0001)	S				
>Scheduled Procedure Step Start Date	(0040,0002)	S				
>Scheduled Procedure Step Start Time	(0040,0003)	S				
>Modality	(0008,0060)	S				
>Scheduled Performing Physician's Name	(0040,0006)		X	X	X	X1
>Scheduled Procedure Step Description	(0040,0007)		X			X
>Scheduled Protocol Code Sequence	(0040,0008)		X			X
>>Code Value	(0008,0100)		X			X
>>Coding Scheme Designator	(0008,0102)		X			X
>>Coding Scheme Version	(0008,0103)		X			X
>>Code Meaning	(0008,0104)		X			X
>Scheduled Procedure Step Location	(0040,0011)		X			
>Pre-Medication	(0040,0012)		X			
>Scheduled Procedure Step ID	(0040,0009)		X			
>Scheduled Procedure Step Status	(0040,0020)					
>Requested Contrast Agent	(0032,1070)					
Requested Procedure						
Requested Procedure ID	(0040,1001)		X	X	X	X2
Requested Procedure Description	(0032,1060)		X		X	X3
Requested Procedure Code Sequence	(0032,1064)		X			X4
>Code Value	(0008,0100)		X			X4
>Coding Scheme Designator	(0008,0102)		X			X4
>Coding Scheme Version	(0008,0103)		X			X4

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Attribute Name	Tag	M	R	Q	UI	IOD
>Code Meaning	(0008,0104)		X			X
Study Instance UID	(0020,000D)		X			X
Referenced Study Sequence	(0008,1110)		X			X
>Referenced SOP Class UID	(0008,1150)		X			X
>Referenced SOP Instance UID	(0008,1155)		X			X
Requested Procedure Priority	(0040,1003)		X			
Names of Intended Recipients of Results	(0040,1010)		X			
Requested Procedure Comments	(0040,1400)		X			
Imaging Service Request						
Accession Number	(0008,0050)		X	X	X	X
Requesting Physician	(0032,1032)		X		X	
Referring Physician's Name	(0008,0090)		X	X	X	X
Requesting Service	(0032,1033)		X			
Imaging Service Request Comments	(0040,2400)		X			
Visit Identification						
Instituation Name	(0008,0080)		X		X	X
Admission ID	(0038,0010)		X			
Visit Status						
Current Patient Location	(0038,0300)		X	X		X
Visit Admission						
Admitting Diagnosis Description	(0008,1080)		X			X
Visit Relationship						
Referenced Patient Sequence	(0008,1120)		X		X	X
>Referenced SOP Class UID	(0008,1150)		X		X	X
>Referenced SOP Instance UID	(0008,1155)		X		X	X
Patient Identification						
Patient's Name	(0010,0010)		X	X	X	X
Patient ID	(0010,0020)		X	X	X	X
Other Patient IDs	(0010,1000)		X			X
Other Patient Names	(0010,1001)		X			X
Patient Demographic						
Patient's Birth Date	(0010,0030)		X	X		X5
Patient's Sex	(0010,0040)		X	X		X
Patient's Weight	(0010,1030)		X	X		X
Patient's Size	(0010,1020)		X	X		X
Patient's Address	(0010,1040)		X			
Military Rank	(0010,1080)		X	X		X
Ethnic Group	(0010,2160)		X			X
Patient Comments	(0010,4000)		X			X
Confidentiality Constraints on Patient Data	(0040,3001)		X			X
Patient Medical						
Patient State	(0038,0500)		X			
Patient's Weight	(0010,1030)		X			X
Pregnancy Status	(0010,21C0)		X			

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Attribute Name	Tag	M	R	Q	UI	IOD
Medical Alerts	(0010,2000)		X			
Contrast Allergies	(0010,2110)		X			
Special Needs	(0038,0050)		X			
Smoking Status	(0010,21A0)		X			
Additional Patient History	(0010,21B0)		X			X
Last Menstrual Date	(0010,21D0)		X			

The table should be read as follows:

Attribute Name: Attributes supported to build a Worklist Request Identifier.

Return Key Type: Mandatory, conditional and optional Return key.

Tag: Appropriate DICOM tag for this attribute.

M: Matching keys for Worklist Update. A "S" will indicate that this attribute contains a value for Single Value Matching.
It can be configured that the attribute is used as Return Key only

R: Return keys. A "x" will indicate that this attribute is a Return Key with zero length for Universal Matching.

Q: Interactive Query Key. A "x" will indicate that this attribute is a matching key, if entered in the Query Patient Worklist dialog. The other keys will then be Return Keys only.

UI: An "x" in the **UI** column will indicate the attribute is displayed in the user interface. The display is influenced by the related configuration.
All return values are visible by selecting the patient and pressing right mouse button.

IOD: An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

The default Query Configuration is set to "Modality" and "Date". Optionally, matching for the own "AE Title" and "Date" is configurable. For "Date" one of the following settings could be configured: "Today", "Yesterday – Today", "Today +/- 12 hours", "Today +/- 24 hours", and "Use no Date".

In Patient based worklist update, the usage of date and time can be deactivated! The Scheduled AE Title is used as Return Key only.

x^1 : "Scheduled Performing Physician's Name (0040,0006)" is not directly included in the header. However, its value is stored in the header as "Performing Physician's Name (0008,1050)". It can be modified by user during Patient Registration.

x^2 : Requested Procedure ID (0040,1001) is directly included in the header in the requested attribute sequence. Additionally, its value is stored in the header as Study ID (0020,0010). Study ID can be modified by the user during Patient Registration.

x^3: Requested Procedure Description (0032,1060) is not directly included in the header. However, its value is stored in the header as "Study Description (0008,1030)". It can be modified by user during Patient Registration.

x^4: Requested Procedure Code Sequence (0032,1064) is not directly included in the header. However, its value is stored in the header as "Procedure Code Sequence (0008,1032)". It is not sent, when the scheduled protocol codes differ from the performed protocol codes.

x^5: If a date of birth (0010,0030) with zero_length value is received via worklist, the date of birth will internally set to 1850/01/01.
The value 1850/01/01 for the date of birth is not used in a DICOM header (DICOM Send, MPPS, CD/DVD Export), but again replaced by zero length.

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The behavior of the Cios Family when encountering status codes in a C-FIND response is summarized in the following table:

Table 16: Status Codes C-FIND RSP ("Update Worklist")

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	none
Success	Matching is complete - No final Identifier is supplied	0000	none
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

4.2.5.3.2 Activity – Get Worklist

4.2.5.3.2.1 Description and Sequencing of Activities

With "Get Worklist" in the patient based Worklist Query dialog, the entered attributes are used to form a worklist request identifier. The response data is used to fill the Patient Registration dialog. The response data and only the response data is placed in the Worklist.

4.2.5.3.2.2 Proposed Presentation Contexts

This Activity will propose the same Presentation Context as with "Update Worklist". Please see related table in section 4.2.5.3.1.2.

4.2.5.3.2.3 SOP Specific Conformance

The Cios Family DICOM worklist SCU supports "narrow worklist queries" with all required search keys. The following tables describe the "narrow query" search keys that the SCU supports.

Table 17: Patient based "narrow query" Search Keys

Attribute Name	Tag	Matching Key Type	Query Value
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Modality	(0008,0060)	R	Input from UI or <zero length>
>Scheduled Performing Physician's Name	(0040,0006)	R	Input from UI or <zero length>
Requested Procedure			
Requested Procedure ID	(0040,1001)	R	Input from UI or <zero length>
Imaging Service Request			

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Attribute Name	Tag	Matching Key Type	Query Value
Accession Number	(0008,0050)	R	Input from UI or <zero length>
Referring Physician's Name	(0008,0090)	R	Input from UI or <zero length>
Patient Identification			
Patient's Name	(0010,0010)	R	Input from UI or <zero length>
Patient ID	(0010,0020)	R	Input from UI or <zero length>

R = Required Key, **O** = Optional Key

The Return Key Attribute handling and supported Status Codes are identical to the "Update Worklist" activity. Please see 4.2.5.3.1.3 for details.

4.2.5.4 Association Acceptance Policy

n.a.

4.2.6 Modality Performed Procedure Step SCU AE Specification

4.2.6.1 SOP Classes

The The Modality Performed Procedure Step AE provides Standard Conformance to the SOP Classes listed in "Table 1: Network Services" section "Worklist Management" in chapter 1 "Conformance Statement Overview".

4.2.6.2 Association Policy

4.2.6.2.1 General

The creation of MPPS Instance is done automatically by Cios Family whenever the first dose is applied to a non-emergency patient.

The default PDU size used will be 64KB.

4.2.6.2.2 Number of Associations

The Cios Family DICOM application initiates one association at a time to create or set the MPPS instance.

4.2.6.2.3 Asynchronous Nature

The Cios Family DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.6.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 "Conformance Statement Overview".

4.2.6.3 Association Initiation Policy

The Cios Family DICOM application will notify a RIS (MPPS Manager) about the status of a procedure while it is performed. It establishes an association by using the

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- N-CREATE DIMSE according to the CREATE Modality Performed Procedure Step SOP Instance operation or a
- N-SET DIMSE to update the contents and state of the MPPS according to the SET Modality Performed Procedure Step Information operation.

It is possible to configure multiple MPPS providers but only one can be active at a time. The active MPPS provider can be configured via Service-UI.

4.2.6.3.1 Activity – Patient registered

4.2.6.3.1.1 Description and Sequencing of Activities

A patient is registered by the Patient Registration "Exam" action. From this event the trigger to create a MPPS Instance is derived. The related Instance is then communicated to the configured RIS system when the first radiation is exposed. An association is established and the MPPS Instance is sent.

4.2.6.3.1.2 Proposed Presentation Contexts

The Cios Family proposes Presentation Contexts as shown in the following table:

Table 18: Proposed Presentation Contexts Activity "Patient Registered"

Presentation Context Table – "Update Flag Information"					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	none
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.6.3.1.3 SOP specific Conformance

Attributes for the Performed procedure Step N-CREATE

The Cios Family DICOM Modality Performed Procedure Step SCU informs the remote SCP when the examination of a scheduled procedure step is performed. The N-CREATE message is sent when the first radiation was exposured for a registered patient. The following table describes the supported attributes of a N-CREATE message:

Table 19: Performed Procedure Step N-CREATE Attributes

Attribute Name	Tag	Type	Value
SOP Common			
Specific Character Set	(0008,0005)	1C	from MWL or created
Performed Procedure Step Relationship			
Scheduled Step Attribute Sequence	(0040,0270)	1	
>Study Instance UID	(0020,000D)	1	from MWL or created
>Referenced Study Sequence	(0008,1110)	2	from MWL or <zero length>
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Accession Number	(0008,0050)	2	from MWL or user input
>Requested Procedure ID	(0040,1001)	2	from MWL or user input
>Requested Procedure Description	(0032,1060)	2	from MWL or <zero length>
>Scheduled Procedure Step ID	(0040,0009)	2	from MWL or <zero length>

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Attribute Name	Tag	Type	Value
>Scheduled Procedure Step Description	(0040,0007)	2	from MWL or <zero length>
>Scheduled Protocol Code Sequence	(0040,0008)	2	from MWL or <zero length>
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Coding Scheme Version	(0008,0103)	3	
>>Code Meaning	(0008,0104)	3	
>Names of Intended Recipients of Result	(0040,1010)	1	from MWL or created
>Requested Procedure Comments	(0040,1400)	2	from MWL or <zero length>
Patient's Name	(0010,0010)	2	from MWL or user input
Patient ID	(0010,0020)	2	from MWL or user input
Patient's Birth Date	(0010,0030)	2	from MWL or user input
Patient's Sex	(0010,0040)	2	from MWL or user input
Referenced Patient Sequence	(0008,1120)	2	from MWL or <zero length>
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Performed Procedure Step Information			
Performed Station AE Title	(0040,0241)	1	own AE Title
Performed Station Name	(0040,0242)	2	own hostname
Performed Location	(0040,0243)	2	from SPS location or <zero length>
Performed Procedure Step Start Date	(0040,0244)	1	created
Performed Procedure Step Start Time	(0040,0245)	1	created
Performed Procedure Step End Date	(0040,0250)	2	<zero length>
Performed Procedure Step End Time	(0040,0251)	2	<zero length>
Performed Procedure Step Status	(0040,0252)	1	"IN PROGRESS"
Performed Procedure Step ID	(0040,0253)	1	From SPS ID or created
Performed Procedure Step Description	(0040,0254)	2	from SPS Description or <zero length>
Performed Procedure Type Description	(0040,0255)	2	<zero length>
Procedure Code Sequence	(0008,1032)	2	from Requested Procedure Code or <zero length>
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	
Image Acquisition Results			
Modality	(0008,0060)	1	XA
Study ID	(0020,0010)	2	from Requested Procedure ID or created
Performed Protocol Code Sequence	(0040,0260)	2	from Scheduled Protocol Code Sequence or <zero length>
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	

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Attribute Name	Tag	Type	Value
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	2	<zero length>
Radiation Dose			
Distance Source to Detector	(0018,1110)	3	<zero length>
Image and Fluoroscopy Area Dose Product	(0018,115E)	3	<zero length>
Total Time of Fluoroscopy	(0040,0300)	3	<zero length>
Total Number of Exposures	(0040,0301)	3	<zero length>
Distance Source to Entrance	(0040,0306)	3	<zero length>
Exposure Dose Sequence	(0040,030E)	3	<zero length>
Comments on Radiation Dose	(0040,0310)	3	<zero length>
Entrance Dose in mGy	(0040,8302)	3	<zero length>
Comments on Radiation Dose	(0040,0310)	3	<zero length>
Billing and Material Management Code			
Billing Procedure Step Sequence	(0040,0320)	3	<zero length>
Film Consumption Sequence	(0040,0321)	3	<zero length>

The Performed Procedure Step SCU interprets only following N-CREATE status codes as Warning or Success:

Table 20: Status Codes MPPS N-CREATE ("Patient Registered")

Service Status	Meaning	Error Codes (0000,0900)
Warning	Attribute List Error.	0107
	Attribute Value out of Range	0116
Success	MPPS Instance created.	0000

4.2.6.3.2 Activity – MPPS Complete

4.2.6.3.2.1 Description and Sequencing of Activities

At the end of examination, the status of the MPPS Instance is set to "COMPLETED".

4.2.6.3.2.2 Proposed Presentation Contexts

For "MPPS Complete" the same Presentation Contexts as with "Patient registered" are proposed. Please see related table in section 4.2.6.3.1.2.

4.2.6.3.2.3 SOP specific Conformance

Attributes for the Performed procedure Step N-SET

The Cios Family DICOM Modality Performed Procedure Step SCU informs the remote SCP about the performed examination and its status. The N-SET message is sent per finished examination (finished status "COMPLETED").
The following table describes the supported attributes of a N-SET message:

Table 21: Performed Procedure Step N-SET Attributes

Attribute Name	Tag	Type	Value
Performed Procedure Step Information			

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Attribute Name	Tag	Type	Value
Performed Procedure Step End Date	(0040,0250)	1	created
Performed Procedure Step End Time	(0040,0251)	1	created
Performed Procedure Step Status	(0040,0252)	3	"COMPLETED"
Performed Procedure Step Description	(0040,0254)	3	from SPS Description or user input
Performed Procedure Type Description	(0040,0255)	2	<zero length>
Procedure Code Sequence	(0008,1032)	3	from Requested Procedure
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Image Acquisition Results			
Performed Protocol Code Sequence	(0040,0260)	3	from Scheduled Protocol Code Sequence
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	1	
>Performing Physician's Name	(0008,1050)	2C	from MWL or user input
>Protocol Name	(0018,1030)	1C	from related SOP Instance
>Operator's Name	(0008,1070)	2C	user input
>Series Instance UID	(0020,000E)	1C	from related SOP Instance
>Series Description	(0008,103E)	2C	from related SOP Instance
>Retrieve AE Title	(0008,0054)	2C	
>Referenced Image Sequence	(0008,1140)	2C	Series related SOP Instances as items
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C	<zero length>
Radiation Dose			
Total Time of Fluoroscopy	(0040,0300)	3	
Total Number of Exposures	(0040,0301)	3	
Entrance Dose in mGy	(0040,8302)	3	accumulated over complete procedure step
Image and Fluoroscopy Area Dose Product	(0018,115E)	3	accumulated over complete procedure step (dGy*cm^2)
Exposure Dose Sequence	(0040,030E)	3	one item for each irradiation event (acquisition or fluoro) if configured
>KVP	(0018,0060)	3	peak KV used for this event (KV)
>X-ray Tube Current in µA	(0018,8151)	3	tube current used for this event
>Exposure Time	(0018,1150)	3	time of x-ray in ms for this event
>Filter Type	(0018,1160)	3	Filter Type

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Attribute Name	Tag	Type	Value
Comments on Radiation Dose	(0040,0310)	3	additional acquisition specific information as text OGP| dGy*cm^2| kV| mAs| Filter|
Billing and Material Management Code			
Film Consumption Sequence	(0040,0321)	3	
>Number of Films	(2100,0170)	3	
>Medium Type	(2000,0030)	3	
>Film Size ID	(2010,0050)	3	

The Performed Procedure Step SCU interprets only the following N-SET status codes as Success.

Table 22: Status Codes MPPS N-SET ("MPPS Update")

Service Status	Meaning	Error Codes (0000,0900)
Success	MPPS Instance created.	0000

Performed Procedure Step ID without MPPS option

Handling of Performed Procedure Step ID in case

- MPPS is not configured or
- Unscheduled case

The attribute "Performed Procedure Step ID" (0040,0235) will be encoded based on Modality Type = XA and DateTime of the first acquired image. The "Performed Procedure Step ID" stays the same for all acquired or derived images as long as the patient is registered.

4.2.6.4 Association Acceptance Policy

n.a.

4.2.7 Print SCU AE Specification

4.2.7.1 SOP Classes

The Print AE provides Standard Conformance to SOP Classes listed in "Table 1: Network Services" section "Print Management" in chapter 1 "Conformance Statement Overview".

4.2.7.2 Association Policy

4.2.7.2.1 General

Whenever a film-sheet is completely set up and printed by command or automated rule, the job is prepared for processing. As soon as the queue is ready to process the job, it is activated and worked according to the processing data. The Print application will initiate an association to the print destination and process the printing.

The default PDU size used will be 64KB.

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4.2.7.2.2 Number of Associations

The Cios Family DICOM application initiates one association at a time for each different print device configured.

4.2.7.2.3 Asynchronous Nature

The Cios Family DICOM print application does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.7.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in chapter 1 "Conformance Statement Overview".

4.2.7.3 Association Initiation Policy

Triggered by the Print job queue the Print Management SCU establishes an association by using the DICOM association services. An N-GET request determines the printer status prior to printing. If the printer status is "normal", the print job is started

4.2.7.3.1 Activity Print Film

4.2.7.3.1.1 Description and Sequencing of Activities

Depending on the film sheet layout all corresponding images are sent via Image Box SOP Class.

If the response from the remote application contains a status other than Success or Warning the association is aborted.

4.2.7.3.1.2 Proposed Presentation Context

The Cios Family proposes Presentation Contexts as shown in the following table:

Table 23: Presentation Contexts for the Activity "Print Film"

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none
Printer SOP Class	1.2.840.10008.5.1.1.16	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none

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Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	none

4.2.7.3.1.3 SOP Specific Conformance

The Cios Family Print SCU conforms to the DICOM Basic Grayscale Print Management Meta SOP Class.

The application uses a configuration platform to define the properties of the connected DICOM SCP, e.g.:

- maximum number of print copies
- supported film sizes of the connected DICOM SCP
- supported film formats of the DICOM SCP

The printing is only suspended in the case of a failure return status of the SCP.

Basic Film Session SOP Class

The Basic Film Session information object definition describes all the user-defined parameters, which are common for all the films of a film session. The Basic Film Session refers to one or more Basic Film Boxes that are printed on one hard-copy printer.

The Cios Family Print Management SCU supports the following DIMSE Service elements for the Basic Film Session SOP Class as SCU:

- N-CREATE
- N-DELETE

The Basic Film Session SOP Class N-CREATE-RQ (SCU) uses the attributes listed in the table below:

Table 24: Attributes for the N-CREATE-RQ of the Basic Film Session

Attribute Name	Tag	Usage SCU	Supported Values
Number of Copies	(2000,0010)	U	Set by user
Print Priority	(2000,0020)	U	MED

U = User Option

The Affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Session.

Table 25: Requested SOP Instance UID on the Basic Film Session

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Session

The Basic Film Session SOP class interprets the status codes (from N-CREATE-RSP messages) listed in the table below:

Table 26: N-CREATE-RSP Status Handling Behavior for the Basic Film Session

Service Status	Further Meaning	Error Codes
Failure	Unable to create print job, print queue is full	C601
	Image size is larger than images box size	C603
Warning	Requested MinDensity or MaxDensity outside of Printer's operating range	B605

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	Film box does not contain image box (empty page)	B602
Success	Film belonging to the film session are accepted for printing	0000

The N-DELETE-RQ on the Basic Film Session SOP Class is used to remove the complete Basic Film Session SOP Instance hierarchy.

Basic Film Box SOP Class

The Basic Film Box information object definition describes all user-defined parameters of one film of the film session including presentation parameters, which are common for all images on a given film sheet.

The Basic Film Box refers to one or more Image Boxes.

The Cios Family Print Management SCU supports the following DIMSE Service elements for the Basic Film Box SOP Class as SCU:

- N-CREATE
- N-ACTION
- N-DELETE

The Basic Film Box SOP Class N-CREATE-RQ message uses the attributes listed below. The actual values for each attribute depend on DICOM printer configuration within the Cios Family DICOM Print Management SCU:

Table 27: Attributes for the N-CREATE-RQ of the Basic Film Session

Attribute Name	Tag	Usage SCU	Supported Values
Image Display Format	(2010,0010)	M	STANDARD\n,n set by user
Referenced Film Session Sequence	(2010,0500)	M	
> Referenced SOP Class UID	(0008,1150)	M	1.2.840.10008.5.1.1.1
> Referenced SOP Instance UID	(0008,1155)	M	
Film Orientation	(2010,0040)	M	(from Camera configuration) PORTRAIT, LANDSCAPE
Film Size ID	(2010,0050)	M	(from Camera configuration) 8INX10IN, 10INX12IN, 11INX14IN, 4INX14IN, 14INX17IN

M = Mandatory, **U** = User Option

The N-CREATE-RSP message from the Print SCP includes the Referenced Image Box Sequence with SOP Class/Instance UID pairs which will be kept internally to be further used for the subsequent Basic Image Box SOP Class N-SET-RQ messages.

When all Image Boxes (including parameters) for the film-sheet have been set, the Cios Family print manager will issue an N-ACTION-RQ message with the SOP Instance UID of the Basic Film Box and the Action Type ID of 1.

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Box.

Table 28: Requested SOP Instance UID on the Basic Film Box

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Box

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The Basic Film Box SOP class interprets the status codes listed in the table below:

Table 29: N-ACTION-RSP Status Handling Behavior for Basic Film Box

Service Status	Meaning	Error Codes
Failure	Unable to create print job, print queue is full	C601
	Image size is larger than images box size	C603
Warning	Film box does not contain image box (empty page)	B603
	Requested Min Density or Max Density outside of printer's operating range.	B605
Success	Film accepted for printing	0000

Basic Grayscale Image Box SOP Class

The Basic Grayscale Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data, which apply to a single image of a sheet of film.

The Grayscale Image Box SOP Class uses only the N-SET-RQ with the attributes listed in the table below:

Table 30: Attributes for N-SET-RQ of Basic Grayscale Image Box

Attribute Name	Tag	Usage SCU	Supported Values
Image Position	(2020,0010)	M	Depending on display format
Basic Grayscale Image Sequence	(2020,0110)	M	
> Samples per Pixel	(0028,0002)	M	1
> Photometric Interpretation	(0028,0004)	M	MONOCHROME2
> Rows	(0028,0010)	M	<Printer/Film config>
> Columns	(0028,0011)	M	<Printer/Film config>
> Pixel Aspect Ratio	(0028,0034)	M	1\1
> Bits Allocated	(0028,0100)	M	8
> Bits Stored	(0028,0101)	M	8
> High Bit	(0028,0102)	M	7
> Pixel Representation	(0028,0103)	M	0
> Pixel Data	(7FE0,0010)	M	

M = Mandatory

The Basic Grayscale Image Box SOP class interprets the status codes as listed below:

Table 31: N-SET-RSP Status Handling Behavior for the Basic Grayscale Image Box SOP Class

Service Status	Further Meaning	Error Codes
Failure	Image contains more pixel than printer can print in Image Box	C603
	Insufficient memory in printer to store the image	C605
Warning	Requested MinDensity or MaxDensity outside of Printer's operating range	B605
Success	Image successfully stored in Image Box	0000

Presentation LUT SOP Class

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The objective of the Presentation LUT is to realize image hardcopy printing tailored for specific modalities, applications and user preferences.

The output of the Presentation LUT is Presentation Values (P-Values). P-Values are approximately related to human perceptual response. They are intended to facilitate common input for hardcopy. P-Values are intended to be independent of the specific class or characteristics of the hardcopy device.

The Presentation LUT SOP Class uses only the N-CREATE-RQ with the attributes listed below:

Table 32: Attributes for N-CREATE-RQ of Presentation LUT SOP Class

Attribute Name	Tag	Usage SCU	Supported Values
Presentation LUT Shape	(2050,0020)	U	IDENTITY

U= User Option

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and is used for later requests on the Basic Film Box (N-CREATE-RQ) and on the Presentation LUT (N-DELETE-RQ).

Table 33: Requested SOP Instance UID on the Presentation LUT

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Presentation LUT

The Presentation LUT SOP class interprets the status codes listed below:

Table 34: N-CREATE-RSP Status Handling Behavior for the Presentation LUT SOP Class

Service Status	Further Meaning	Error Codes
Warning	Requested MinDensity or MaxDensity outside of HCD's operating range. HCD will use its respective minimum or maximum density value instead.	B605
Success	Presentation LUT successfully created	0000

Printer SOP Class

The Printer SOP Class provides the possibility to monitor the status of the hardcopy printer in a synchronous and in an asynchronous way.

The SCU uses the mandatory N-EVENT Report DIMSE service to monitor the changes of the printer status in an asynchronous way.

The following returned information is supported:

Table 35: Used Printer N-EVENT Report attributes

Event-type Name	Event	Attributes	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

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U = **User Option**

Table 36: Mandatory Printer N-GET-RSP, N-EVENT-REPORT-RQ attributes

Attribute Name	Tag	Usage SCP	Supported Values
Printer Status	(2110,0010)	M	NORMAL, FAILURE, WARNING
Printer Status Info	(2110,0020)	M	

M = Mandatory

4.2.7.4 Association Acceptance Policy

n.a.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The The Cios Family provides DICOM 3.0 TCP/IP network communication support as defined in Part 8 of the DICOM Standard and uses the TCP/IP protocol stack from the operating system. It uses the MergeCOM subroutine library. All available Ethernet interfaces are supported.

4.3.2 Additional Protocols

none

4.3.3 IPv4 Support

IPv4 is supported.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

AE Titles shall be unique within the hospital. A common way to achieve that is to use the hostname as part of the AE Titles. The string can be up to 16 characters and must not contain any extended characters. Only 7-bit ASCII characters (excluding Control Characters) are allowed according to the DICOM Standard.

4.4.1.1 Local AE Titles

Change of the default AE Titles chosen by the system can be performed in the Service UI under "FLC Service / Configuration / DICOM Local Settings" item - first page.

Table 37: Default AET Characteristics

Application Entity	Default AE Title	TCP/IP Port
Storage SCU	FLC_STORE_SCU	-

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Application Entity	Default AE Title	TCP/IP Port
Storage SCP	FLC_STORE_SCP	104 (fixed)
Query/Retrieve SCU	FLC_STORE_SCU	-
Print SCU	FLC_STORE_SCU	-
Worklist SCU	FLC_WK_SCU	-
MPPS SCU		-

4.4.1.2 Remote AE Title

For each remote AE the following data and capabilities can be configured:

Table 38 - Remote AE Configuration Items

Remote AE configuration item	Comment
Host Name	As defined in the network domain. This has to be configured also for any DICOM AE that wishes to connect to SCP services of Cios Family.
TCP/IP address	As defined in the network domain. This has to be configured also for any DICOM AE that wishes to connect to SCP services of Cios Family.
Logical Name(Alias)	Name for the AE used in the user interfaces of the Cios Family applications.
AE Title	AET, as provided by network administration
Port Number	Port Number, as provided by network administration
If Storage Service support is checked	
Archive Node	When checked, sending to remote AET will set status of a(rchived), else s(ent) is indicated.
StC node Server	Select a previously configured alias for Storage Commitment when sending DICOM objects to the configured AE.
If Storage Commitment Service support is checked	
Timeout for Result in same association	Timeout in seconds to wait at the open association.
If Modality Worklist Service support is checked	
No Default Character Set used in Query	Checkbox to activate the option, that no default character set shall be used for the query message. Default: Deactivated.
Query Waiting time	The time in sec (1-999) to wait for the C-FIND-RSP after sending the C-FIND-RQ (default 20 sec.)
Max Query Match Number	The maximum number of entries accepted in one worklist (default is 200)
Query Interval	The time between two C-FIND-RQ to the Hospital Information system (default is 60 min, minimum is 3 min, maximum is 1440 min i.e. 24 hours)
Time Range	User configuration: +/- n hours

4.4.1.2.1 Remote Association Acceptors

For remote applications that shall be able to accept DICOM associations from Cios Family, the following information needs to be available:

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- Application Entity Title
- Host Name / IP address on which the remote application service runs
- Port number on which the remote application accepts association requests.

The remote system will be indicated in the UI of Cios Family with a logical name, that is also entered when configuring the node in the administration UI.

4.4.2 Parameters

The next table lists configuration parameters, which are true for all Application Entities.

Table 39: Parameter List

Time-out Values				
Parameter	**Default Value[sec]**	**Min [sec]**	**Max [sec]**	**Comment**
Accepting/Rejecting an Association Request	60	15	600	Wait for an Association Request or wait for a Peer to shut down the Association
Association Open Request	60	15	600	Wait for a reply to an Association Accept Request
Association Close Request	60	15	600	Wait for a reply to an Association Release Request
Accepting a Message over Network	60	15	600	Wait for a Network Write to be accepted
Waiting for Data between TCP/IP Packets	60	15	600	Wait for Data between TCP/IP packets
Accept network connect	15	15	600	Wait for a Network Connect to be accepted
General Transfer Setting				
Simultaneous DICOM associations	10	1	10	Number of simultaneous associations running.
Maximum PDU Size	64kByte	4kByte	1MByte	Proposed PDU size, each selectable value is doubled from previous, starting with 4kB. Additionally, for optimization for some networks 28kByte are provided.

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5 Media Interchange

5.1 Implementation Model

5.1.1 Application Data Flow Diagram

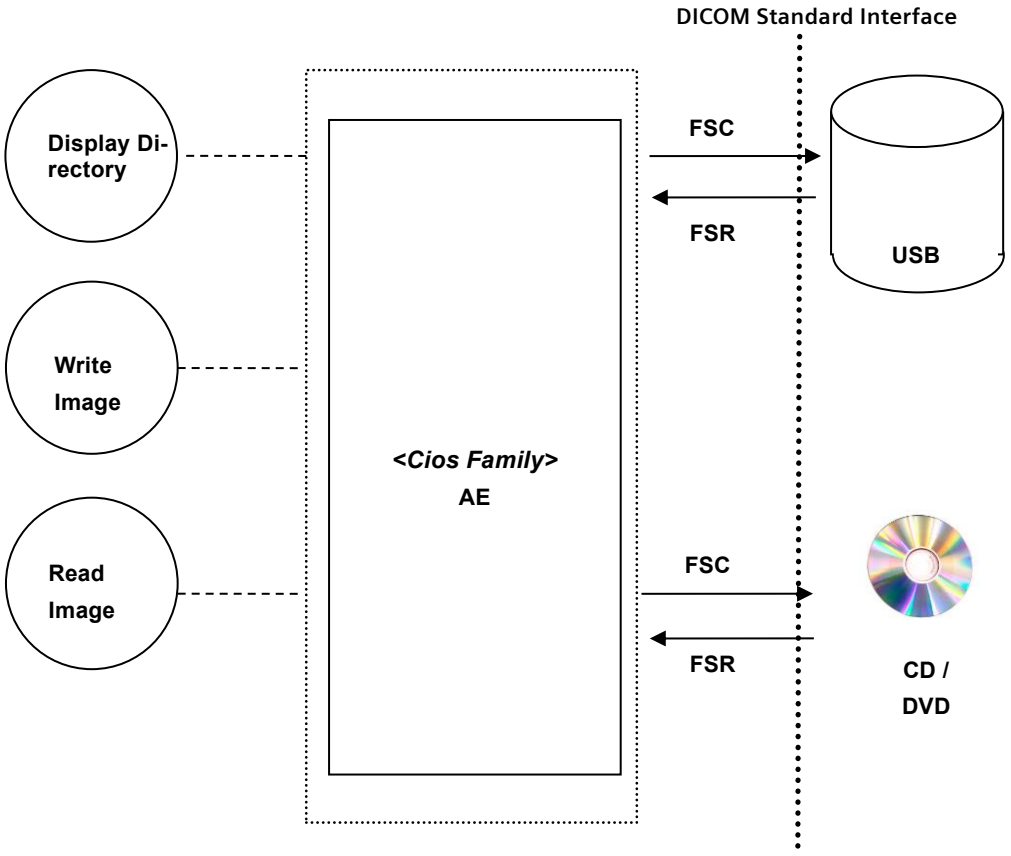

Figure 3: Media Interchange Application Data Flow Diagram

The DICOM Archive application will serve as an interface to the CD-R/DVD/USB offline medium device.

The DICOM Archive application will support the 120mm CD-R/DVD/USB medium.

The FSU role will update new SOP Instances only to media with pre-existing File-sets conforming to the Application Profiles supported.

The contents of the DICOMDIR will temporarily be stored in Archive-Database.

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5.1.2 Functional definitions of AEs

The DICOM Offline Media Storage application consists of the DICOM Archive application entity serving all interfaces to access offline media. The DICOM Archive application is capable of

- creating a new File-set in the File System (Export to ...)
- updating an existing File-set by writing new SOP Instances onto the medium (Export to...).
- importing SOP Instances from the medium onto local storage
- reading the File-sets DICOMDIR information into temporary database and pass it to display applications.

5.1.3 Sequencing of Real-World Activities

The DICOM Archive application will not perform transfers until the Directory information of the DICOMDIR is completely read in and displayed in the Browser.

5.2 AE Specifications

5.2.1 Media Storage AE – Specification

The Cios Family provides conformance to the following Application Profiles.

Table 40: Media - Application Profiles and Real-World Activities

Application Profiles Supported	Real-World Activity	Role	Service Class Option
STD-GEN-CDSTD-GEN-DVD STD-GEN-USB	Browse Directory Information	FSR	Interchange
	Import into local Storage	FSR	
	Export to local Archive Media	FSC , FSU	

5.2.1.1 Real-World Activities

5.2.1.1.1 Activity "Browse Directory Information"

The Cios Family acts as FSR using the interchange option when requested to read the media directory.

The Cios Family will read the DICOMDIR and insert those directory entries that are valid for the application profiles supported, into a local database. The database then is used for browsing media contents.

Note: The "Icon Image Sequence" is also supported in DICOMDIR. But only those Icon Images with "Bits Allocated" (0028,0100) equal to 8 and size of 64x64 or 128x128 pixels are imported into database and are visible in the Browser.

5.2.1.1.2 Real World Activity "Import into Application"

The Cios Family application acts as FSR using the interchange option when requested to read SOP Instances from the medium into the local storage.

The SOP Instance selected from the media directory will be copied into the local storage. Only SOP Instances, that are valid for the application profile supported and supported by Cios Family, can be retrieved from media.

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For media conforming to the STD-GEN-xxx Profile the following SOP Classes will be supported as FSR:

Table 41: STD-GEN-xxx profile supported SOP Classes

Information Object Definition	Transfer Syntax UID
Any image SOP Class detailed in "Table 1: Network Services" section "Transfer (Image SOP Class)".	Explicit VR Little Endian 1.2.840.10008.1.2.1

5.2.1.1.3 Real-World Activity "Export to local Archive Media"

The Cios Family application acts as FSU (for media with existing DICOM file-set) or FSC (media not initialized) using the interchange option when requested to copy SOP Instances from the local storage to local Archive Medium.

The Cios Family application will receive a list of SOP Instances to be copied to the local archive medium. According to the state of the medium inserted (new medium, Medium with DICOM file-set) the validity of the SOP Instances according to the applicable profile is checked. Only valid SOP Instances are accepted.

Table 42: STD-GEN-xxx profile supported SOP Classes

Information Object Definition	Transfer Syntax UID
X-Ray Angiographic Image Storage	Explicit VR Little Endian 1.2.840.10008.1.2.1
X-Ray Radiation Dose SR	
Secondary Capture Image Storage (as Exam Protocol)	
Multi-frame True Color Secondary Capture Image Storage	

The DICOM Archive application will not finalize the medium.

With the resizing feature of the Cios Family DICOM application, downsized images (8bit) as well as processed images can be written onto medium.

Restrictions and Extensions:

The DICOM Offline Storage application supports only SOP Instances generated by the application.

5.3 Augmented and private Application Profiles

n.a.

5.4 Media Configuration

5.4.1 Single- / Multi-Session CD burning

Cios Family always uses the multi-session recording mode.

5.4.2 "Viewer on CD"

***syngo* FastView** as application is included onto the medium as part of the "Viewer on CD" feature, if the feature is checked in the Media Creation user interface.

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5.4.3 Auto-Labeling

The format of the label is FLC_DDMMYY_HHMM.

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6 Support of Extended Character Sets

The Cios Family DICOM application supports the following character sets:

- ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)
- ISO_IR 144 (Cyrillic, supplementary set of ISO 8859, used when Russian patient data input is configured)
- GB18030 (used when Chinese patient data input is configured)
- ISO 2022 IR 13, ISO 2022 IR 87 and ISO 2022 IR 159 (used when Japanese patient data input is configured)

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7 Attribute confidentiality profiles

7.1 De-identification

The Cios Family application can de-identify attributes, when exporting to Media.

Table 43: Application Level Confidentiality Profile attributes (standard tags)

DICOM Tag	Attribute Name	Anonymized
(0008,0050)	Accession Number	Yes
(0008,0080)	Institution Name	Yes
(0008,0090)	Referring Physician's Name	Yes
(0008,1050)	Performing Physician's Name	Yes
(0010,0010)	Patient’s Name	Yes
(0010,0020)	Patient ID	Yes
(0010,0030)	Patient’s Birth Date	Yes
(0010,1000)	Other Patient IDs	Yes
(0010,1001)	Other Patient Names	Yes
(0010,1040)	Patient's Address	Yes
(0010,1080)	Military Rank	Yes
(0010,21B0)	Additional Patient History	Yes
(0040,0275)	Request Attributes Sequence	Yes

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8 Security

The Cios Family is supporting security by having the firewall of the underlying operating system active. Besides the standard ports of the operating system, only the DICOM Port (104) is opened.

Cios Family only accepts DICOM communication from other AE if the related System is configured with its hostname, port and AET.

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9 Annexes

9.1 IOD Contents

9.1.1 Created SOP Instances

9.1.1.1 X-Ray Angiographic Image Standard Extended SOP Class

The Cios Family system will create images during acquisition and with post processing applications. Those will be encoded as XA Standard Extended SOP Class. Please see the following table for a complete overview of supplied Type 1/2/3 Standard and additional Private Attributes:

The following table uses a number of abbreviations. The abbreviations used in the "Presence of ..." column are:

VNAP Value Not Always Present (attribute sent zero length if no value is present)
ANAP Attribute Not Always Present
ALWAYS Always Present
EMPTY Attribute is sent without a value

The abbreviations used in the "Source" column:

MWL the attribute value source Modality Worklist
USER the attribute value source is from User input
AUTO the attribute value is generated automatically
MPPS the attribute value is the same as that use for Modality Performed Procedure Step
CONFIG the attribute value source is a configurable parameter

Table 44: XA acquired or derived image

Attribute Name	Tag	VR	Value	Presence of Value	Source
Specific Character Set	(0008,0005)	CS	From Configuration / RIS	ALWAYS	MWL / CONFIG
Image Type	(0008,0008)	CS	See SOP Common Module - Image Type Extensions	ALWAYS	AUTO
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.12.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Created, same UID used for different send option	ALWAYS	AUTO
Study Date	(0008,0020)	DA	<yyyymmdd>	ALWAYS	AUTO
Series Date	(0008,0021)	DA	<yyyymmdd>	ALWAYS	AUTO
Acquisition Date	(0008,0022)	DA	Date of Original Acquisition (X-Ray event)	ALWAYS	AUTO
Content Date	(0008,0023)	DA	Date of Original Acquisition (X-Ray event)	ALWAYS	AUTO
Study Time	(0008,0030)	TM	<hhmmss>	ALWAYS	AUTO
Series Time	(0008,0031)	TM	<hhmmss>	ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM	Time of Original Acquisition (X-Ray event)	ALWAYS	AUTO
Content Time	(0008,0033)	TM	Time of Original Acquisition (X-Ray event)	ALWAYS	AUTO
Accession Number	(0008,0050)	SH	RIS or "Accession No." input	ALWAYS	MWL / USER
Modality	(0008,0060)	CS	XA	ALWAYS	AUTO

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Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Siemens	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	RIS or "Institution Name" input	ALWAYS	MWL / USER / CONFIG
Institution Address	(0008,0081)	ST	RIS or configuration input	ANAP	MWL/CONFIG
Referring Physician's Name	(0008,0090)	PN	RIS or input	VNAP	MWL / USER
Station Name	(0008,1010)	SH	from Configuration hostname	ALWAYS	CONFIG
Study Description	(0008,1030)	LO	Requested Procedure Description (0032,1060) from Modality Worklist or Application Group	ALWAYS	MWL / AUTO
Procedure Code Sequence	(0008,1032)	SQ	Requested Procedure Code Sequence (0032,1062) from Modality Worklist	ANAP	MWL
Series Description	(0008,103E)	LO	Application Name	ALWAYS	USER / AUTO
Performing Physician's Name	(0008,1050)	PN	Performing Physician	ANAP	MWL / USER
Operator's Name	(0008,1070)	PN	"Operator 1"\"Operator 2" input	ANAP	USER
Admitting Diagnosis Description	(0008,1080)	LO	"Admitting Diagnosis"	ANAP	MWL
Manufacturer's Model Name	(0008,1090)	LO	Fluorospot Compact S1	ALWAYS	AUTO
Referenced Study Sequence	(0008,1110)	SQ	From RIS	ANAP	MWL
>Referenced SOP Class UID	(0008,1150)	UI	From RIS	ANAP	MWL
>Referenced SOP Instance UID	(0008,1155)	UI	From RIS	ANAP	MWL
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	Set when MPPS is configured	ANAP	MPPS
>Referenced SOP Class UID	(0008,1150)	UI	Set when MPPS is configured	ANAP	MPPS
>Referenced SOP Instance UID	(0008,1155)	UI	Set when MPPS is configured	ANAP	MPPS
Referenced Patient Sequence	(0008,1120)	SQ	From RIS	ANAP	MWL
>Referenced SOP Class UID	(0008,1150)	UI	From RIS	ANAP	MWL
>Referenced SOP Instance UID	(0008,1155)	UI	From RIS	ANAP	MWL
Referenced Image Sequence	(0008,1140)	SQ	From RIS	ANAP	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	From RIS	ANAP	AUTO

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Attribute Name	Tag	VR	Value	Presence of Value	Source
>Referenced SOP Instance UID	(0008,1155)	UI	From RIS	ANAP	AUTO
Derivation Description	(0008,2111)	ST	Notes about transformation steps	ALWAYS	AUTO
Recommended Display Frame Rate	(0008,2144)	IS	(in f/s)	ANAP	AUTO
Irradiation Event UID	(0008,3010)	UI	Unique for one irradiation event	ALWAYS	AUTO
Patient's Name	(0010,0010)	PN	RIS or "Patient Name" input	ALWAYS	MWL / USER
Patient ID	(0010,0020)	LO	RIS or "Patient ID" input	ALWAYS	MWL / USER
Patient's Birth Date	(0010,0030)	DA	RIS or checked "Date of Birth" input	ALWAYS	MWL / USER
Patient's Sex	(0010,0040)	CS	RIS or input (M or F or O/unknown)	ALWAYS	MWL / USER
Other Patient IDs	(0010,1000)	LO	From RIS / Social Security Number	ANAP	MWL / USER
Other Patient Names	(0010,1001)	PN	From RIS	ANAP	MWL
Patient's Age	(0010,1010)	AS	Calculated from "Date of Birth" input	ALWAYS	AUTO
Patient's Size	(0010,1020)	DS	Patient’s height in meters	ANAP	MWL / USER
Patient’s Weight	(0010,1030)	DS	(in kilograms)	ANAP	MWL / USER
Patient’s Address	(0010,1040)	LO	Patient’s Address	ANAP	MWL/ USER
Military Rank	(0010,1080)	LO	From RIS	ANAP	MWL / USER
Ethnic Group	(0010,2160)	SH	From RIS	ANAP	MWL
Additional Patient History	(0010,21B0)	LT	From RIS	ANAP	MWL
Patient Comments	(0010,4000)	LT	"Additional Info"	ANAP	MWL/USER
Contrast/Bolus Agent	(0018,0010)	LO	“IODINE” or “CO2”	VNAP	AUTO
Cine Rate	(0018,0040)	IS	<acquired frame rate>	ANAP	AUTO
KVP	(0018,0060)	DS	<peak KV used> (KV)	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	<modality serial number>	ALWAYS	AUTO
Software Version	(0018,1020)	LO	VG10	ALWAYS	AUTO
Protocol Name	(0018,1030)	LO	Application Name	ALWAYS	AUTO
Frame Time	(0018,1063)	DS	(msec/frame) for fixed frame rates	ANAP	AUTO

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Attribute Name	Tag	VR	Value	Presence of Value	Source
Distance Source to Detector	(0018,1110)	DS	(mm) SID	ALWAYS	AUTO
Distance Source to Patient	(0018,1111)	DS	(mm) Only if (0018,1110) is present - shall present if SOD or TOD is known, that means the image is calibrated	ANAP	AUTO
Estimated Radiographic Magnification Factor	(0018,1114)	DS	<Ratio of SID/SOD>	ANAP	AUTO
Field of View Shape	(0018,1147)	CS	"ROUND" for intensifier "RECTANGLE" for detector images	ANAP	AUTO
Field of View Dimensiion	(0018,1149)	IS	Mm|mm\mm	ANAP	AUTO
Exposure Time	(0018,1150)	IS	<duration of x-Ray exposure>(msec)	ALWAYS	AUTO
X-Ray Tube Current	(0018,1151)	IS	(mA)	ALWAYS	AUTO
Exposure	(0018,1152)	IS	(mAs)	ALWAYS	AUTO
Exposure in µAs	(0018,1153)	IS	(µAs)	ALWAYS	AUTO
Average Pulse Width	(0018,1154)	DS	(msec)	ALWAYS	AUTO
Radiation Setting	(0018,1155)	CS	SC	ALWAYS	AUTO
Radiation Mode	(0018,115A)	CS	CONTINUOUS | PULSED	ALWAYS	AUTO
Image and Fluoroscopy Area Dose Product	(0018,115E)	DS	In dGy cm^2	ALWAYS	AUTO
Filter Type	(0018,1160)	DS	Defined Terms: NONE,CU_0.1[2|3]_MM	ALWAYS	AUTO
Intensifier Size	(0018,1162)	DS	diameter of intensifier	ANAP	AUTO
Imager Pixel Spacing	(0018,1164)	DS	<row space, col space>(mm)	ALWAYS	AUTO
Grid	(0018,1166)	DS	NONE | FOCUSSED	ALWAYS	AUTO
Date of Last Calibration	(0018,1200)	DA	<yyyymmdd>	ALWAYS	AUTO
Acquisition Device Processing Code	(0018,1401)	CS	"1" Advanced Spatial Noise Filtering is used "0" not used	ALWAYS	AUTO
Positioner Motion	(0018,1500)	CS	STATIC	ANAP	AUTO
Positioner Type	(0018,1508)	CS	CARM	ANAP	AUTO
Positioner Primary Angle	(0018,1510)	DS	The definition of DICOM "with respect to the patient position" is fulfilled, if the c_arm is moved from the left towards the patient and the detector is positioned above the patient	VNAP	AUTO
Positioner Secondary Angle	(0018,1511)	DS	The definition of DICOM "with respect to the patient position" is fulfilled, if the c_arm is moved from the left towards the patient and the detector is positioned above the patient	ALWAYS	AUTO
View Position	(0018,5101)	CS	empty	ANAP	AUTO

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Attribute Name	Tag	VR	Value	Presence of Value	Source
Detector Conditions Nominal Flag	(0018,7000)	CS	YES NO, if user was notified	ALWAYS	AUTO
Detector Temperature	(0018,7001)	DS	<actual value>	ALWAYS	AUTO
Detector Type	(0018,7004)	CS	SCINTILLATOR	ALWAYS	AUTO
Detector Description	(0018,7006)	LT	Factory Serial Number	ALWAYS	AUTO
Detector ID	(0018,700A)	SH	Factory Serial Number	ALWAYS	AUTO
Date of Last Detector Calibration	(0018,700C)	DA	<yyyymmdd>	ALWAYS	AUTO
Time of Last Detector Calibration	(0018,700E)	TM	<hhmmss>	ALWAYS	Auto
Field of View Origin	(0018,7030)	DS	<actual value>	ALWAYS	AUTO
Field of View Rotation	(0018,7032)	DS	"0","90","180" or "270"	ALWAYS	AUTO
Field of View Horizontal Flip	(0018,7034)	CS	"YES" or "NO"	ALWAYS	AUTO
Grid Focal Distance	(0018,704C)	DS		ANAP	AUTO
X-Ray Tube Current in µA	(0018,8151)	DS	(µA)	ALWAYS	AUTO
Study Instance UID	(0020,000D)	UI	From RIS or system generated	ALWAYS	MWL / AUTO
Series Instance UID	(0020,000E)	UI	generated	ALWAYS	AUTO
Study ID	(0020,0010)	SH	From RIS Requested Procedure ID or system created	ALWAYS	MWL / USER / AUTO
Series Number	(0020,0011)	IS	generated	ALWAYS	AUTO
Acquisition Number	(0020,0012)	IS	generated	ALWAYS	AUTO
Instance Number	(0020,0013)	IS	generated	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	Zero length	ALWAYS	AUTO
Laterality	(0020,0060)	CS	Zero length	ALWAYS	USER
Image Comments	(0020,4000)	LT	If entered in UI	VNAP	USER
Samples per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
Number of Frames	(0028,0008)	IS	<number of frames>	VNAP	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1063) or (0018,1065) for variable frame rate	VNAP	AUTO

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Attribute Name	Tag	VR	Value	Presence of Value	Source
Rows	(0028,0010)	US		ALWAYS	AUTO
Columns	(0028,0011)	US		ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8 | 16	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8 | 16 | 12	ALWAYS	AUTO
High Bit	(0028,0102)	US	7 | 15 | 11	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Burned In Annotation	(0028,0301)	CS	"NO"	ALWAYS	AUTO
Pixel Intensity Relationship	(0028,1040)	CS	LIN | LOG | DISP	ALWAYS	AUTO
Window Center	(0028,1050)	DS	<NAT value> 2 values if (0028,1040) = LOG	ALWAYS	AUTO / USER
Window Width	(0028,1051)	DS	<NAT value> 2 values if (0028,1040) = LOG	ALWAYS	AUTO / USER
Window Center & Width Explanation	(0028,1055)	LO	Subtraction only	ANAP	AUTO
Recommended Viewing Mode	(0028,1090)	CS	SUB | NAT	VNAP	AUTO / USER
Lossy Image Compression	(0028,2110)	CS	"00"	ALWAYS	AUTO
Modality LUT Sequence	(0028,3000)	SQ	(if [0028,1040] = LOG)	ANAP	AUTO
>LUT Descriptor	(0028,3002)	VR	<number of LUT entries>, <first pixel value mapped>, <Entry bits allocated>	ANAP	AUTO
>Modality LUT Type	(0028,3004)	LO	US	ANAP	AUTO
>LUT data	(0028,3006)	US-OW	<array of data, accord. descriptor>	ANAP	AUTO
Representative Frame Number	(0028,6010)	US	For multiframes	ANAP	AUTO
Mask Subtraction Sequence	(0028,6100)	SQ	n.a.	ANAP	AUTO
>Mask Operation	(0028,6101)	CS	AVG_SUB	ANAP	AUTO
>Mask Frame Number	(0028,6110)	US	(only for AVG_SUB)	ANAP	AUTO
Study ID Issuer	(0032,0012)	LO	internal study identifier	ALWAYS	AUTO
Requesting Physician	(0032,1032)	PN	From RIS	ANAP	MWL
Requesting Service	(0032,1033)	LO	From RIS	ANAP	MWL
Requested Procedure Description	(0032,1060)	LO	From RIS	ANAP	MWL

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Attribute Name	Tag	VR	Value	Presence of Value	Source
Requested Procedure Code Sequence	(0032,1064)	SQ	From RIS	ANAP	MWL
>Code Value	(0008,0100)	SH	From RIS	ANAP	MWL
>Coding Scheme Designator	(0008,0102)	SH	From RIS	ANAP	MWL
>Coding Scheme Version	(0008,0103)	SH	From RIS	ANAP	MWL
>Code Meaning	(0008,0104)	LO	From RIS	ANAP	MWL
Study Comments	(0032,4000)	LT	Patient Registration input	ANAP	USER
Current Patient Location	(0038,0300)	LO	From RIS	ANAP	MWL
Performed Procedure Step Start Date	(0040,0244)	DA	supplied, even if MPPS SOP Class is not supported	ALWAYS	AUTO
Performed Procedure Step Start Time	(0040,0245)	TM	supplied, even if MPPS SOP Class is not supported	ALWAYS	AUTO
Performed Procedure Step ID	(0040,0253)	SH	supplied, even if MPPS SOP Class is not supported, "XAyyyymmddhhmmss" is set with 1st Image acquired	ALWAYS	AUTO
Performed Procedure Step Description	(0040,0254)	LO	Value of Study Description	ALWAYS	AUTO
Performed Protocol Code Sequence	(0040,0260)	SQ	Same as 0040,0275>0040,0008	ANAP	MWL
Request Attributes Sequence	(0040,0275)	SQ	From RIS	ANAP	MWL
>Scheduled Procedure Step Description	(0040,0007)	LO	From RIS	ANAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	From RIS	VNAP	MWL
>Scheduled Procedure Step ID	(0040,0009)	SH	From RIS	VNAP	MWL
>Requested Procedure ID	(0040,1001)	SH	From RIS or "Request ID" input	VNAP	MWL / USER
Confidentiality Constraint on Patient Data Description	(0040,3001)	LO	From RIS	ANAP	MWL
Pixel Data	(7FE0,0010)	OB-OW	Pixel data	ALWAYS	AUTO

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9.1.1.2 Exam Protocol as SC Image

The Cios Family will generate an X-Ray Radiation Dose SR object to store all dose and acquisition relevant information for all irradiation events. An excerpt of this information is displayed to the user as "Exam Protocol". This displayed Exam Protocol can be converted to an SC image. The pixel data contain the protocol data as an image.

All patient level, study level and equipment information is taken from the acquired images of the related procedure.

Acquisition specific information (e.g. KVP, mA) and further information is set either to default values (type 1), set to zero length (type 2) or not set at all.

9.2 Data Dictionary of Private Attributes

"Table 45: Private Data Element Dictionary" lists all private attributes created by Cios Family which may be included in the generated instances. These values are intended for internal use only:

Table 45: Private Data Element Dictionary

Attribute Name	Tag	VR
(0017,xx0A)	Blackening correction	SS
(0017,xx0B)	Dose Level	SS
(0017,xx0C)	SDM	SS
(0017,xx0D)	Frame rate	FL
(0017,xx0E)	Characteristic curve	LO
(0017,xx0F)	Cupper Filter	LO
(0017,xx10)	Skin Dose	SS
(0017,xx11)	Focus	SS
(0017,xx16)	Bone level (white/black)	US
(0017,xx17)	Contrast	US
(0017,xx18)	Brightness	US
(0017,xx1B)	Flip H	US
(0017,xx1C)	Flip V	US
(0017,xx1E)	Zoom (On / Off)	US
(0017,xx1F)	Pan X	SS
(0017,xx20)	Pan Y	SS
(0017,xx21)	Harmonization	US
(0017,xx22)	DSA Mask index	US
(0017,xx23)	DSA display sub/nat	US
(0017,xx24)	DSA Contrast	US
(0017,xx25)	DSA Brightness	US
(0017,xx27)	Landmark	US
(0017,xx28)	Pixelshift X	FL
(0017,xx29)	Pixelshift Y	FL
(0017,xx48)	Series number	SS
(0017,xx49)	Label	SS
(0017,xx4D)	Series / Single flag	SS
(0017,xx4E)	Series date	LO
(0017,xx4F)	Series time	LO
(0017,xx50)	Image type	SS

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Attribute Name	Tag	VR
(0017,xx54)	Harmonization Kernel	SS
(0017,xx55)	DSA flag	SS
(0017,xx66)	Bone level (white/black)	US
(0017,xx67)	Contrast	US
(0017,xx68)	Brightness	US
(0017,xx85)	Harmonization kernel	US
(0017,xx86)	DSA Mask index	US
(0017,xx87)	DSA display sub/nat	US
(0017,xx88)	DSA Contrast	US
(0017,xx89)	DSA Brightness	US
(0017,xx8B)	Landmark	US
(0017,xx8C)	Pixelshift X	FL
(0017,xx8D)	Pixelshift Y	FL
(0017,xx8E)	Shutter X	US
(0017,xx8F)	Shutter Y	US
(0017,xx90)	FD config: FlipV	US
(0017,xx91)	FD config: FlipH	US
(0017,xx92)	FD config: Rotation	US
(0017,xx93)	FD config: Orientation	US
(0017,xxA0)	Laterality	US
(0017,xxA1)	R/L label	US
(0017,xxA2)	X,Y value respective to cropped	US
(0017,xxAA)	System type	US
(0017,xxAB)	Ortho Technique	US
(0017,xxB0)	Detector calibration temperature	DS
(0017,xxBF)	name of the performed OGP	LO
(0017,xxC0)	name of the performed Exam	LO
(0017,xxC1)	Anatomical measurement	US
(0017,xxC2)	Data Model	US
(0017,xxC3)	Mark number	US
(0017,xxC4)	RIS name	US
(0017,xxD0)	Acc. Fluoro time	US
(0017,xxD1)	Acc. Dose Area Product	LO
(0017,xxD2)	Acc. Skin Dose	LO
(0017,xxE1)	K-Factor	US

9.2.1 Usage of Attributes from received IODs

Please refer to the "SOP specific conformance..." sections in the DICOM networking part of this DCS for more details on attribute specific handling.

9.2.2 Attribute mapping

The relationships between attributes received via Modality Worklist, stored in acquired images and communicated via MPPS are summarized in "Table 14: Broad Worklist Query Search Keys".

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The Cios Family DICOM Application is not performing data coercion.

9.3 Coded Terminology and Templates

The Cios Family will create X-Ray Radiation Dose SRs implementing TID 10001 Projection X-Ray Radiation Dose. For every single irradiation event an entry is made into the SR. Reference Point Definition is "30cm in Front of Image Input". The following 3 tables describe main attributes.

Table 46: General X-Ray Dose Data

Concept Name	Comment
Patient Table Relationship	“headfirst”
Patient Orientation	“recumbent”
Patient orientation Modifier	“supine”

Table 47: Accumulated X-Ray Dose Data

Concept Name	Comment
Dose Area Product Total	The accumulated dose area product (measured with dose chamber) including fluoro and acquisition
Dose (RP) Total	Calculated accumulated dose at the RP applied during fluoro and acquisition
Fluoro Dose Area Product Total	The accumulated dose area product applied during fluoro
Fluoro Dose (RP) Total	Calculated accumulated dose at the RP applied during fluoro
Total Fluoro Time	Total time of fluoro performed in this plane [s].
Acquisition Dose Area Product Total	The accumulated dose area product applied during acquisition
Total Acquisition Time	Total time of acquisition performed in this plane [s].
Distance Source to Reference Point	Distance from the X-Ray Source to the Reference Point

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Table 48: Dose SR Irradiation Event Data

Concept Name	Comment
Irradiation Event Type	Fluoroscopy | Stationary Acquisition
Acquisition Protocol	Name of the OGP
Dose Area Product	Dose Area Product applied
Dose (RP)	Calculated dose at the Reference Point
X-Ray Filters	Information about used filter
Fluoro Mode	Pulsed|Continuous
Pulse Rate	Used Pulse Rate
Number of Pulses	Number of X-Ray pulses
KVP	Mean value
X-Ray Tube Current	Mean value in mA
Exposure Time	Total time the patient has received X-Ray exposure during the irradiation event.
Pulse Width	Average Pulse Width
Exposure	Exposure in µAs
Target Region	Entire Body
Distance Source to Detector	SID in mm
Positioner Primary Angle	Patient-based angle of the primary plane in [deg]. *
Positioner Secondary Angle	Patient-based angle of the secondary plane in [deg]. *
Collimated Field Area	Collimated field area at detector plane in [m2].
Collimated Field Height	Collimated field height at detector plane in [mm].
Collimated Field Width	Collimated field width at detector plane in [mm].
Focal Spot Size	Size of the focal spot in [mm] that was used during the performance of this irradiation event.

* The definition of DICOM "with respect to the patient position" is fulfilled, if the c_arm is moved from the left towards the patient and the detector is positioned above the patient. In case the System has no position sensors the value '0' is set.

9.4 Grayscale Image Consistency

The high resolution TFT display monitor option of Cios Family comes with a DICOM Grayscale Standard Display Function (GSDF) compliant factory pre-setting. A typical working environment setup is assumed for ambient light.

9.5 Standard Extended / Specialized / Private SOP Classes

9.5.1 Standard Extended XA

The XA SOP Instances created by Cios Family are standard-extended by adding the following private module attributes.

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Table 49: Standard Extended XA

IE	Module	Reference	Usage	Note
Image	Raw Data	9.5.1.1 Raw Data	U	private Filter Information
	Post Processing	9.5.1.2 Post Processing Module	U	private Viewing information
	Acquisition Data	9.5.1.3 Acquisition Data Module	U	additional private Information about image Acquisition

U = User Option

9.5.1.1 Raw Data

Following shadow owner code is used: "Siemens: Thorax/Multix FD Raw Image Settings".

9.5.1.2 Post Processing Module

Following shadow owner code is used: "Siemens: Thorax/Multix PostProcessing".

9.5.1.3 Acquisition Data Module

Following shadow owner code is used: "SIEMENS_FLCOMPACT_VA01A_PROC".

9.5.1.4 SOP Common Module - Image Type Extensions

Additional values for the image type attribute are used to designate the purpose of the SOP instance created by the Cios Family system. Please see the following table for details.

Table 50: Image Type Extensions

Type of Scene/Image	Image Type
Standard Fluoro Image	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO
Fluoro Image Single	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\SINGLE
Fluoro Image Scene	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\LOOP
SUB Single Image	ORIGINAL\PRIMARY\SINGLE PLANE\STORE MONITOR\SUB
SUB Peak Opacification	ORIGINAL\PRIMARY\SINGL EPLANE\ STORE MONITOR\PEAKOP
Standard SUB Series	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\SUB
Fluoro Image Last Image Hold	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\LIH
Roadmap Single Image	ORIGINAL\PRIMARY\SINGLE PLANE\ROADMAP\SINGLE
Standard Roadmap Series	ORIGINAL\PRIMARY\SINGLE PLANE\ROADMAP\LOOP
Standard DR	ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\DR
Dose Report as Secondary Capture / Exam Protocol	DERIVED\SECONDARY\SINGLE PLANE\EXAMPROTOCOL

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9.6 Private Transfer Syntaxes

No private Transfer Syntaxes are defined for or requested by Cios Family DICOM application.

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Siemens Healthineers Headquarters
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen, Germany
Phone: +49 9131 84-0
siemens-healthineers.com

Manufacturer
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen, Germany

Manufacturer
Siemens Shanghai
Medical Equipment Ltd.
No. 278, Zhouzhu Road
Shanghai, 201318
P. R. China

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